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# **Old Age Security Program Mortality Experience**

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OSFI  
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## Foreword

The Old Age Security (OAS) Program provides a basic pension to all Canadians aged 65 or older who meet a minimum residency requirement. This mortality study provides an analysis of the mortality characteristics of OAS Program beneficiaries over the period from 2005 to 2009.

Increasing life expectancies, the aging of the baby boomers, and fertility rates that have been below replacement level for some time are the predominant factors that have contributed to a large increase in the proportion of elderly in the Canadian population. A significant increase in the proportion of elderly in the population is expected over the next 20 years, after which an increase is expected to continue, but at a slower rate. The proportion of the total population aged 65 and above will grow from 14% of the population in 2010 to 23% by 2030. Older age groups will experience even higher rates of growth. Under the OAS Program, which is financed from general revenues, the number of recipients of the basic pension is expected to increase from 4.7 million in 2010 to 9.3 million in 2030. Expenditures of the OAS Program are expected to increase from \$36 billion in 2010 (or 2.3% of GDP) to \$109 billion in 2030 (or 3.1% of GDP).

As the OAS Program provides the payment of old age basic benefits to almost all Canadians aged 65 and over, the availability of an administrative OAS beneficiaries database allows for a more accurate measurement of the level and trend in mortality experienced by the oldest portion of the Canadian population. This study indicates how current trends in mortality at older ages compare with past trends and how the resulting shape of the survival curve changes as income increases.

Intuitively, individuals with a higher standard of living are expected to experience lower mortality than those with a lower standard of living due to an overall healthier lifestyle and higher income. In addition to studying the overall mortality of older Canadians by age, sex and marital status, this study also analyses mortality in terms of income, which is the most common variable used in defining an individual's socioeconomic status. For this study, a measure of income was determined from the type and amount of monthly OAS Program benefits received over the study period. These benefits include the income-tested Guaranteed Income Supplement (GIS), which is paid in addition to the basic OAS pension in cases where there is low income.



## I. Executive Summary

### A. Purpose

This study is the second mortality experience study of the Old Age Security (OAS) Program published by the Office of the Chief Actuary (OCA). This study presents estimates of the level of mortality of beneficiaries of the OAS Program who were aged 65 or older during the period running from 1 January 2005 to 31 December 2009. The previous study covered the period from 1 January 1999 to 31 December 2003. The OAS database used for this study reflects over 21 million life-years of exposure and about 920,000 deaths. The volume and type of data allows the study of the level of mortality experienced at advanced ages with more accuracy and reliability compared to other sources of information. As the OAS Program provides monthly benefits to almost all Canadians aged 65 and over, an analysis of the mortality experience of the Program beneficiaries provides a good indication of the mortality experience of the oldest portion of the Canadian population.

The OAS Program beneficiaries' mortality experience is first evaluated on an overall basis and then by various subgroups that take into account place of birth, the type and amount of OAS benefits paid over the experience period, marital status, and income. The previous study identified subgroups of beneficiaries with high incomes, as their level of basic OAS pension received was reduced through a provision of the *Income Tax Act* referred to as the "OAS Repayment provision"; the reduction is also referred to as the "OAS Recovery Tax". This study does not present estimates of the level of mortality for these subgroups because of the corresponding low amounts of exposure. This study does however, examine the mortality of beneficiaries by whether or not their basic OAS pensions are increased by the Guaranteed Income Supplement (GIS), which depends on the level of income. The mortality experience of the OAS subgroup that resides in Canada outside of Québec is also analyzed, specifically between those receiving a Canada Pension Plan (CPP) retirement pension and those not receiving the pension.

In this study, the OAS Program mortality experience was compared to a benchmark mortality table: the 2007 Canadian Human Mortality Database (CHMD) table<sup>1</sup>. The life expectancies at age 65 resulting from this table compare well with figures published by Statistic Canada for the year 2007. This benchmark mortality table is also the starting point for the mortality projections of the most recent actuarial report<sup>2</sup> on the OAS Program as at 31 December 2009.

The OCA will use the results of this study to assess the mortality characteristics of the overall Canadian population and the CPP and OAS Program beneficiaries when producing its next triennial actuarial reports on the CPP and OAS Program.

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<sup>1</sup> The Canadian Human Mortality Database is produced by the Mortality and Longevity research team at the Department of Demography, Université de Montréal (<http://bdlc.umontreal.ca/chmd/>).

<sup>2</sup> The most recent actuarial report refers to the 10<sup>th</sup> Actuarial Report Supplementing the (9<sup>th</sup>) Actuarial Report on the OAS Program as at 31 December 2009.



## **B. Scope**

Section II presents an overview of historical Canadian population trends as presented in the most recent OAS Program Actuarial Report. Section III presents a summary of the data and methodology used to determine the mortality rates experienced by OAS Program beneficiaries over the period 2005 to 2009. A detailed analysis of the results is then presented in Section IV. Section V presents the mortality improvement rates for various subgroups of beneficiaries, while Section VI presents life expectancies at age 65. The conclusions of the study follow in Section VII. Lastly, various appendices in Section VIII provide statistics and further details in respect of the methodology used, and list the references used and contributors to this study.

## **C. Main Findings**

- The overall mortality of OAS beneficiaries in Canada is 5% higher for males and 3% higher for females relative to the 2007 mortality table used in the most recent OAS Program Actuarial Report. The mortality difference is especially higher (i.e. 7%) for males age 80 and over but is relatively constant for females.
- At ages 65 to 69, male OAS Program beneficiaries experience mortality rates that are 62% higher than females. However, the gap in mortality rates between the sexes declines significantly by age. For ages 85 to 89, mortality rates for males are 40% higher than females.
- Based on estimated OAS Program beneficiaries' mortality rates for the year 2007, life expectancies at age 65 for beneficiaries are 17.8 years for males and 21.0 years for females. These are lower than the life expectancies corresponding to the most recent OAS Actuarial Report by 0.4 year for males and 0.3 year for females.
- The life expectancies at age 65 for those who receive OAS without GIS benefits because of sufficiently high income are 18.6 years for males and 21.9 years for females. This group of high-income earners experiences higher life expectancies compared to low-income earners who do receive GIS benefits. The life expectancies at age 65 for those who receive GIS benefits because of low income are 16.2 years for males (i.e., 2.4 years lower) and 19.8 years for females (2.1 years lower).
- A high level of income is a long-term predictor of lower mortality, and conversely, a low level of income is a long-term predictor of higher mortality. However, the difference in mortality by level of income decreases with advancing age.
- OAS beneficiaries who are born outside Canada (i.e. immigrants) experience lower mortality than beneficiaries who were born in Canada. Consequently, OAS beneficiaries born outside of Canada have greater life expectancies at age 65 than those born in Canada. The differentials at age 65 are 1.8 years for males and 1.5 years for females.

- The greater life expectancies of immigrants as well as their relative better health compared to those born in Canada may be explained by a "healthy immigrant effect"<sup>1</sup>, which results from several factors, including medical and employability screening prior to entry to Canada as well as cultural and lifestyle characteristics.
- There is a significant difference by age and sex in the distribution of life-years of exposure by marital status. For example, for the age group 65 to 69, the proportion of married males (in terms of life-years of exposure) not in receipt of GIS benefits is 81%, while for females the corresponding proportion is 70%. For the age group 85 to 89, these proportions are 61% for males and 23% for females.
- For the age group 65 to 69, the proportion of single males in receipt of GIS benefits is 36%, while for females the corresponding proportion is 58%. For the age group 85 to 89, these proportions are 46% for males and 91% for females.
- For the Program, married males experience lower mortality than single males. However, married females experience lower mortality than single females only up to age 91; thereafter, married females experience higher mortality than their single counterparts.
- For the age group 65 to 69, married males experience mortality that is 20% lower than the overall male mortality for the Program, but this percentage decreases to 2% at the advanced ages. For the same age group, single males experience mortality that is 63% higher than the overall male mortality, but that gradually converges to the overall level at the advanced ages.
- For the age group 65 to 69, married females experience mortality that is 20% lower than the overall female mortality for the Program. This percentage falls to 3% at the advanced ages and then rises after age 95. Single females aged 65 to 69 experience mortality that is 31% higher than the overall female mortality, but that gradually converges to the overall level at the advanced ages.
- While there are a few exceptions, for both sexes in general, single beneficiaries in receipt of the GIS experience the highest mortality at all ages. For both sexes, the subgroup with the lowest mortality corresponds to married beneficiaries not in receipt of GIS benefits.
- Males show higher differentials in life expectancy at age 65 than females by marital status. Married males live on average 18.8 years or 3.3 years longer than single males at age 65. In comparison, married females live on average 21.9 years or 1.7 years longer than single females at age 65.

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<sup>1</sup> Chen, J., R. Wilkins, and E. Ng. 1996. *Health Expectancy by Immigrant Status, 1986 and 1991*. Health Reports. Statistics Canada. 8(3): 29-38.

- For those beneficiaries without GIS benefits, married males are expected to live on average 19.3 years or 2.6 years longer than single males. In comparison, for the same benefit subgroup, married females are expected to live on average 22.5 years or 1.4 years more than single females.
- For those beneficiaries with GIS benefits, married males are expected to live on average 17.6 years or 3.5 years more than single males. In comparison, for the same benefit subgroup, married females are expected to live on average 20.7 years or 1.3 years more than single females.

#### **D. Conclusion**

The availability and quality of the administrative OAS beneficiaries' database provide sufficient and reliable data upon which this study is based and allow for a more accurate measurement of the level and trend in mortality experienced by the oldest portion of the Canadian population.

The aging of the Canadian population has increased substantially since the inception of the OAS Program in 1952. Over the last decade, life expectancy at age 65 of the general population has experienced the largest ever increase since the Program's inception, with life expectancy at age 65 increasing by about two years to reach 20 years in 2010.

This study also shows that while the growth in the Canadian population is slowing down, the segment of the population aged 80 and older has been one of the fastest growing age groups, and this trend is expected to continue. Mortality rates between the ages of 80 and 90 have recently decreased at a pace of about three times faster than that observed over the previous two decades.

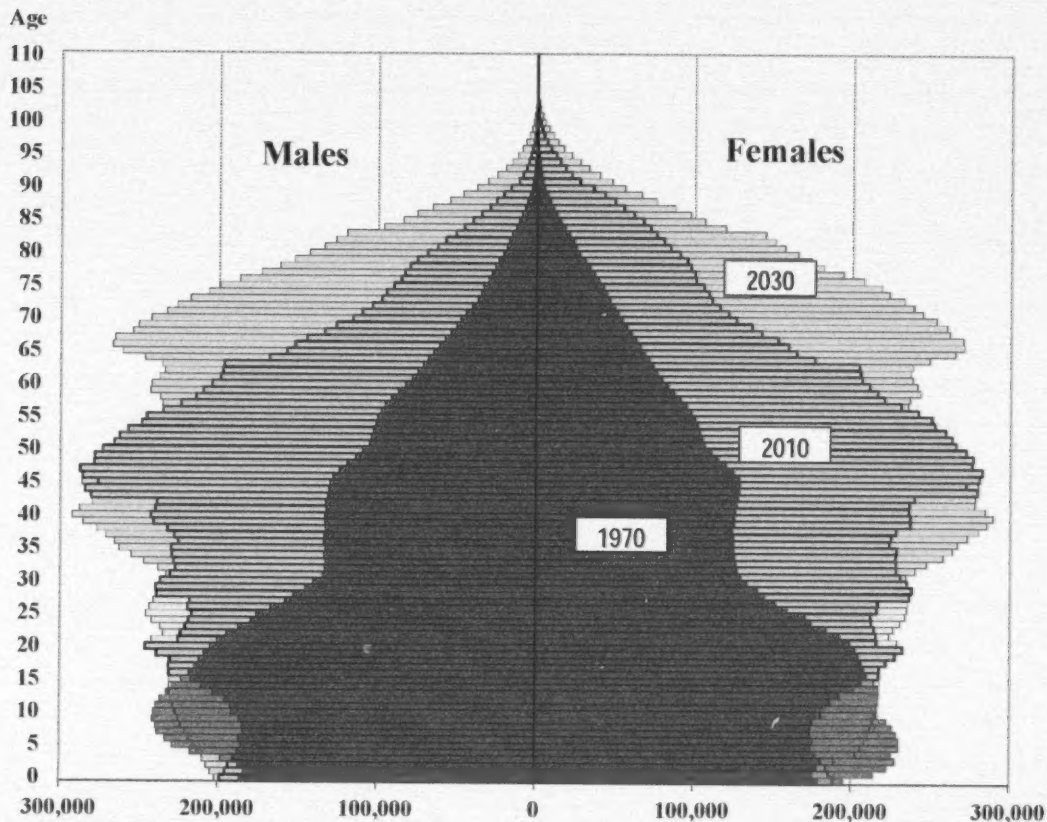
In general, GIS recipients experience higher mortality and thus lower life expectancies relative to the overall OAS Program population. In comparison, those who do not receive GIS benefits experience lower mortality and higher life expectancies. In 2007, male OAS pensioners without GIS benefits had a life expectancy at age 65 of 18.6 years, which was 0.8 year higher than the overall level for male OAS beneficiaries and 2.4 years higher than male GIS recipients. Female pensioners without GIS benefits had a life expectancy of 21.9 years, or 0.9 year higher than the overall female level and 2.1 years higher than female GIS recipients. These observations may be explained by the relationship between high levels of income and improved health and quality of life.



## II. Canadian Population Trends

The significant improvement in life expectancy over the last 40 years for those aged 65 and older is an important cause of the aging of the Canadian population. Historically, most of the increase in life expectancy resulted from the reduction in mortality prior to age 65. However, recent increases in life expectancy have been mainly due to a reduction in mortality at ages 65 and above. The Canadian population has also aged due to a significant drop in the total fertility rate since the late 1950s and the aging of the baby boom generation (those mainly born between the mid-1940s and mid-1960s). Chart 1 shows the importance of the impact of the baby boom generation on the population for years 1970, 2010 and 2030 as the bulk of the age structure moves up into the older ages over time.

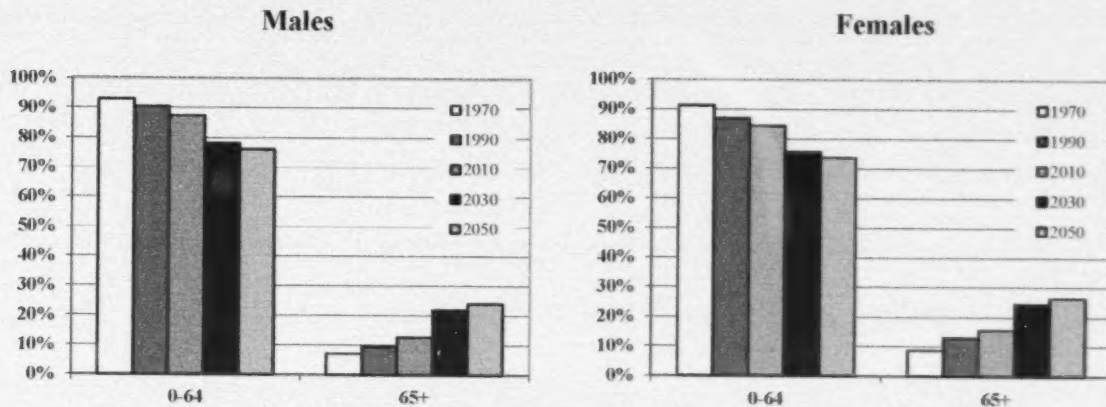
**Chart 1 Age Structure of the Canadian Population**



The historical and projected evolution of the proportions of the population aged less than 65 and aged 65 and over is shown in Chart 2. In 2010, 13% of males and 16% of females in the population were aged 65 or older. By 2030, these proportions are expected to grow significantly to 22% and 24% for males and females, respectively.

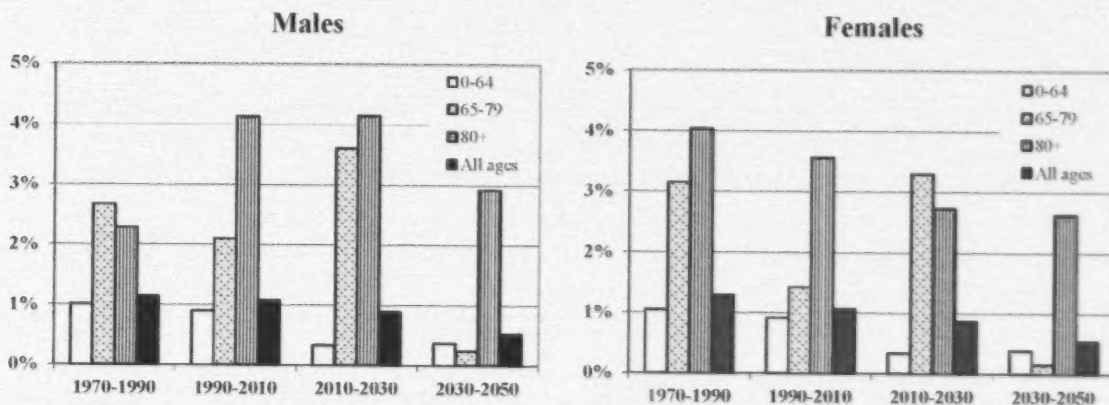


**Chart 2 Distribution of the Canadian Population Below and Above Age 65**



The historical and projected annualized growth rate by age group of the Canadian population is shown in Chart 3. While as a whole, the growth of the Canadian population is slowing down, the age group of those aged 80 and over has been one of the fastest growing age groups, and this trend is expected to continue. As the growth in the population at the advanced ages is expected to remain strong, an increasing number of individuals are expected to become centenarians.

**Chart 3 Average Annual Growth of the Canadian Population by Age Group**



Life expectancy at age 65 provides a good measure of how long Old Age Security benefits will be paid for both sexes. As shown in Table 1, life expectancy at age 65 for males was 13.8 years in 1970 and increased to 18.8 years by 2010, representing a growth of 36%. For women, life expectancy at age 65 in 1970 was 17.5 years and increased to 21.6 years over the same period, representing a growth of 23%. For both sexes, life expectancy at age 65 has increased steadily over the period 1970 to 2010. It is interesting to note that the difference between female and male life expectancies at age 65 has narrowed from 4.2 years in 1980 to 2.8 years in 2010. This can be explained by the fact that mortality improvement rates of males aged 65 years or older have been significantly higher than for females of the same age over this period.

**Table 1 Evolution of Canadian Life Expectancy at Age 65**

Year	Life Expectancy at Birth			Life Expectancy at Age 65		
	Males	Females	Difference	Males	Females	Difference
1901*	47.1	50.1	3.0	11.0	12.0	1.0
1911*	50.9	54.2	3.3	11.3	12.4	1.1
1921	56.0	58.2	2.2	13.3	13.9	0.6
1925	58.1	60.5	2.4	13.1	13.8	0.7
1930	57.6	60.3	2.7	12.9	13.9	1.0
1940	62.5	65.7	3.2	12.8	14.1	1.3
1950	66.2	70.6	4.4	13.3	15.0	1.7
1960	68.2	74.2	6.0	13.6	16.2	2.6
1965	68.8	75.2	6.4	13.6	16.7	3.1
1970	69.3	76.3	7.0	13.8	17.5	3.7
1975	70.0	77.2	7.2	14.0	18.0	4.0
1980	71.6	78.7	7.1	14.5	18.7	4.2
1985	73.0	79.7	6.7	14.8	19.2	4.4
1990	74.2	80.6	6.4	15.5	19.7	4.2
1995	75.0	81.0	6.0	15.9	19.8	3.9
2000	76.7	81.8	5.1	16.8	20.3	3.5
2005	77.9	82.5	4.6	17.8	20.9	3.1
2010**	79.3	83.5	4.2	18.8	21.6	2.8

\* Life expectancies for 1921 to 2005 are from the CHMD. Pre-1921 life expectancies were taken from the "Abridged Period Table" for Canada by Statistics Canada.

\*\* From the 10<sup>th</sup> Actuarial Report Supplementing the (9<sup>th</sup>) Actuarial Report on the OAS Program as at 31 December 2009.

The evolution of the Canadian population aged 65 and over has a direct impact on the OAS Program, since the Program provides a monthly basic OAS pension to all Canadians aged 65 and over who meet the residence and legal status requirements specified in the *Old Age Security Act*. According to the most recent OAS Actuarial Report, the number of recipients of the basic OAS pension is expected to double from 4.6 million in 2009 to 9.3 million in 2030. The number of recipients of the GIS is also expected to double over the same period, growing from 1.6 million in 2009 to 3.3 million in 2030.

The increasing population aged 65 and over continues to influence the costs of social security programs like the OAS Program. It is thus critical to be able to measure as precisely as possible the mortality experience of this age group. The future experience of mortality at older ages may evolve in many different ways and possibly in line with one of several theories, such as the theory of squaring of the survival curve (also called "mortality compression") or the theory of steady progress (also called "mortality expansion"). A survival curve at age 65 shows the probability of a 65 year old reaching a given age.

Mortality compression at the older ages occurs if age-specific mortality declines over a widening range of older ages but meets a natural limit for very advanced ages, assuming there is a limit to the maximum lifespan. This is consistent with the aging process being both continuous and accompanied by an increasing degree of frailty. Mortality compression is thus also consistent with exponential growth in mortality rates.

In the case of mortality expansion, the age at which a natural limit occurs could move upward; that is, the maximum age to which one could expect to live would continuously increase. Consequently, all age groups would continue to experience declining mortality. This is consistent with a logistic<sup>1</sup> form of the mortality curve, which has a more gradual growth in mortality at the advanced ages.

### *Analysis of Mortality by Major Causes of Death*

As shown in Table 2, an analysis of the major causes of death in Canada indicates that the incidence of various causes differs by sex and age. Malignant neoplasms are the leading cause of death at ages 65 up to 80, while circulatory system diseases are the leading cause of death at ages 80 and above. Respiratory system diseases as a cause of death are more prominent for males than females at the older ages. The proportion of deaths attributable to diabetes mellitus decreases for both sexes at the older ages. As age increases, both sexes experience an increasing proportion of deaths related to circulatory system diseases and Alzheimer's disease. The increasing proportion of deaths related to other causes may be associated with the fact that comorbidity increases with age.

**Table 2 Number and Proportion of Deaths by Cause of Death, Age, and Sex (2008)\***

Cause of Death	Males					Females				
	65-69	70-79	80-89	90+	65+	65-69	70-79	80-89	90+	65+
<b>Malignant neoplasms</b>	4,526	11,524	9,282	1,738	27,070	3,623	8,925	8,781	2,459	23,788
<b>Circulatory system diseases</b>	2,814	8,734	11,855	4,358	27,761	1,293	5,788	14,756	10,682	32,519
<b>Respiratory system diseases</b>	711	2,758	4,339	1,636	9,444	470	2,179	3,938	2,624	9,211
<b>Diabetes mellitus</b>	400	1,127	1,217	268	3,012	257	836	1,422	635	3,150
<b>Alzheimer's disease</b>	43	399	1,080	405	1,927	53	570	2,239	1,714	4,576
<b>Other causes</b>	1,855	5,525	7,930	3,124	18,434	1,237	4,562	10,580	8,068	24,447
<b>All causes</b>	<b>10,349</b>	<b>30,067</b>	<b>35,703</b>	<b>11,529</b>	<b>87,648</b>	<b>6,933</b>	<b>22,860</b>	<b>41,716</b>	<b>26,182</b>	<b>97,691</b>

Cause of Death	Males					Females				
	65-69	70-79	80-89	90+	65+	65-69	70-79	80-89	90+	65+
<b>Malignant neoplasms</b>	44%	38%	26%	15%	31%	52%	39%	21%	9%	24%
<b>Circulatory system diseases</b>	27%	29%	33%	38%	32%	19%	25%	35%	41%	33%
<b>Respiratory system diseases</b>	7%	9%	12%	14%	11%	7%	10%	9%	10%	9%
<b>Diabetes mellitus</b>	4%	4%	3%	2%	3%	4%	4%	3%	2%	3%
<b>Alzheimer's disease</b>	0%	1%	3%	4%	2%	1%	2%	5%	7%	5%
<b>Other causes</b>	18%	18%	22%	27%	21%	18%	20%	25%	31%	25%
<b>All causes</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

\* Statistics Canada. *Leading Causes of Death, total population, by age group and sex, Canada, annual*. CANSIM [database on-line]. Table 102 0561: 2011.

<sup>1</sup> A logistic curve is an S-shaped curve that models the growth of a given population over time. It is characterized by low initial growth, followed by a period of rapid or exponential growth, and then ending with a gradual slowing down to an equilibrium level as the population matures.

Table 3 shows the annual rates of mortality improvement by main causes of death over the period 2000 to 2008 using aggregated mortality rates by age group and sex. For the population aged 65 and older, the mortality improvement rates across all age groups are significantly higher for deaths related to circulatory system diseases compared to malignant neoplasms and all causes combined.

**Table 3 Annual Mortality Improvement Rates by Cause of Death (2000-2008)\***

Age Group	Males			Females		
	Malignant neoplasms	Circulatory system diseases	All causes**	Malignant neoplasms	Circulatory system diseases	All causes**
65-69	1.7%	4.9%	2.5%	0.3%	5.1%	1.5%
70-74	2.1%	5.6%	3.0%	0.5%	4.9%	1.8%
75-79	1.8%	5.7%	3.0%	0.3%	5.5%	2.0%
80-84	1.5%	5.8%	2.9%	0.6%	5.3%	2.3%
85-89	0.8%	4.6%	2.1%	0.1%	4.3%	1.7%
90+	1.7%	3.8%	2.0%	0.9%	3.7%	1.6%

\*Source: Statistics Canada. *Leading Causes of Death, total population, by age group and sex, Canada, annual*. CANSIM [database on-line]. Table 102 0561: 2011.

\*\* Includes malignant neoplasms, circulatory system diseases and all other causes.

The observed mortality improvements can be associated with increasing prosperity, changes in behaviour, and public health and medical advances. However, the generally lower mortality improvement rates at advanced ages reflect the fact that it is more difficult to improve mortality at those ages.

Section V of this study shows detailed information on mortality improvement rates of OAS beneficiaries by type of benefit.



### III. Data and Methodology

#### A. Data

The main source of data for this study is an administrative serialtim (i.e., by non-identifiable individual record) OAS Program beneficiary database that was provided by the Department of Human Resources and Skills Development Canada (HRSDC), which is the administrator of the OAS Program. The OAS database contains information on the amount of regular monthly benefits received by each OAS Program beneficiary along with the associated payment status (i.e., whether in pay, suspended or terminated) at each December 31 for years 2001 to 2009 inclusive. This database allows the determination of those entitled to the GIS benefit in addition to the basic OAS pension due to having no or very low income<sup>1</sup>

The second database used for this study, the Canada Revenue Agency (CRA) database available for years 2005 to 2009 inclusive, allowed the identification of marital status, if not already determined from the OAS database, for those individuals who filed tax returns.

The mortality experience of OAS beneficiaries was first estimated on an overall basis and then by subgroups taking into account the type of benefit received. The main subgroups considered are as follows:

1. **Basic OAS with GIS:** OAS beneficiaries entitled to both a basic OAS pension and income-tested GIS benefit.
2. **Basic OAS without GIS:** OAS beneficiaries not entitled to the GIS benefit.

The mortality experience of those beneficiaries subject to the Repayment provision<sup>2</sup> was not considered in this study because of the corresponding low amount of exposure, i.e., 6% of total exposure and only 4% for those aged 90 or older.

The mortality experience of OAS beneficiaries is also estimated on a marital status basis for each subgroup that takes into account the type of benefit received over the period of the study.

A third database used for this study is an administrative serialtim Canada Pension Plan (CPP) retirement beneficiary database, which allowed the determination of those OAS beneficiaries who were also in receipt of a CPP retirement pension. For OAS beneficiaries residing in Canada outside of Québec, mortality experience was analyzed based on whether or not a CPP retirement pension was payable.

<sup>1</sup> The level of income used to determine the level of GIS entitlement excludes any benefits received from the OAS Program, as well as Employment Insurance premiums, CPP/QPP contributions, a portion of employment income, and various other types of income.

<sup>2</sup> The Repayment Amount of the basic OAS pension for Canadian residents in a given year is based on a beneficiary's net income and a certain threshold. For OAS beneficiaries residing outside of Canada, the reduction is referred to as the Recovery Tax and is based on net world income. For each dollar of net income above the threshold, 15 cents of the basic OAS pension received over the year will be recovered. In 2011, the threshold was \$67,668 and the pension is completely reduced at a net income level at or above \$110,123.

For all OAS beneficiaries who are reported as being age 100 or older at the end of a year, a validation of date of birth and date of death information was performed by HRSDC. Results of the validation found that all of the records of the centenarian's death records were accurate, while about 400 centenarians were recorded as being suspended although they had been deceased for a number of years before the study period. The identification of these cases in the OAS database by HRSDC improved the accuracy of the data for all ages.

Both the CRA database and the CPP retirement beneficiary file were used as independent sources of information to validate the data consistency with the OAS beneficiary database. For instance, by using the three files it was possible to:

- exclude records that were inconsistent with respect to sex, date of birth, and date of death.
- generate a deemed date of death for records in the OAS database that were missing a date of death but where the payment status information in the OAS database had strongly suggested the occurrence of death.

Table 4 presents data validation statistics. As shown in the table, the data are deemed to be reliable, since only 0.07% of the records were excluded from the study.

**Table 4 Data Validation Statistics**

	<b>Total OAS Database</b>
<b>Number of records in study period prior to exclusions:</b>	<b>5,491,979</b>
<b>Exclusions:</b>	
Unknown or inconsistent sex indicator	2,133
Inconsistent date of birth	1,763
Inconsistent OAS entitlement age	103
Erroneous date of death	4
<b>Total records excluded</b>	<b>4,003</b>
<b>Number of records in study period after exclusions</b>	<b>5,487,976</b>
<b>Proportion of records excluded</b>	<b>0.07%</b>

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## **B. Methodology Overview**

This section provides a general overview of the methodology used in the development of the mortality rates of Canadian resident OAS beneficiaries who were aged 65 or older during the period 1 January 2005 to 31 December 2009.

The final mortality rates are for the calendar year 2007 and are derived using the following four-step process:

### **1. Production of Annual Crude Mortality Rates**

The crude mortality rate for a given age last birthday in any given calendar year is the probability that a person at that age on 1 January dies by 31 December of that year. Crude mortality rates are usually calculated by simply dividing the relevant number of deaths by the number of life-years that were exposed to risk of death over that period. There exist various methods to determine crude mortality rates. For this study, annual crude mortality rates are determined using the Product-Limit Estimator (PLE) method, also known as the Kaplan-Meier Product-Limit Estimator method. Further details of this method are provided in Appendix B. The results of various death and exposure tabulations are given in section IV.A.

### **2. Production of 2007 Base Year Crude Mortality Rates**

The 2007 base year crude mortality rates are derived from the annual crude mortality rates over the period 2005 to 2009. The methodology used to derive the year 2007 rates is described in detail in Appendix C.

### **3. Production of 2007 Base Year Graduated Mortality Rates**

The 2007 base year crude mortality rates are then graduated to reflect a compromise between smoothness and fit. A Whittaker-Henderson Type B graduation method is used to produce the graduated rates up to age 95, which is the highest age showing statistically credible mortality rates.

### **4. Extension of Mortality Rates to Age 120**

The same logistic curve approach of the most recent OAS Program Actuarial Report is used to extend mortality rates to age 120. The resulting mortality rates at age 120 are 700 deaths per thousand for males and 650 deaths per thousand for females.

## IV. Results

### A. Overall OAS Program Beneficiaries' Mortality

The OAS Program provides monthly benefits to almost all Canadians aged 65 and over. The availability of an administrative OAS database allows for a more accurate measurement of the level and trend in mortality experienced by the oldest portion of the Canadian population.

#### 1. Deaths

The basis for the estimation of the OAS Program beneficiaries' mortality rates is to count the number of deaths by calendar year, age and sex. Since only the month and year of birth is available from the OAS database, the day of birth for each OAS beneficiary is assumed to be in the middle of the month. Similarly, since only the month and year of death is available, the day of death is assumed to be in the middle of the month.

Special adjustments are made in cases where both the months of birth and death are the same. For these cases, a uniform distribution of births and deaths is assumed such that, on average, half the deaths occur before the date of death and the other half occur after. This results in about half the number of deaths occurring at the exact age at death and the other half at an age one year younger.

Table 5 presents the number and proportion of deaths of OAS Program beneficiaries at ages 65 and over by age group and sex. Of the 920,585 observed deaths, there are 9,846 classified as centenarians (83% being females), and among those, 26 (96% being females) died as supercentenarians (i.e., at ages 110 or older).

**Table 5 OAS Program Deaths (2005-2009)**

Age Group	OAS Program					
	Number of Deaths			Distribution		
	Males	Females	Both Sexes	Males	Females	Both Sexes
65-69	50,821	33,417	84,238	12%	7%	9%
70-74	66,356	46,894	113,250	15%	10%	12%
75-79	87,783	69,414	157,197	20%	14%	17%
80-84	96,698	97,565	194,263	22%	20%	21%
85-89	78,427	108,918	187,344	18%	22%	20%
90-94	42,003	83,436	125,438	10%	17%	14%
95-99	12,053	36,958	49,010	3%	8%	5%
100+	1,674	8,172	9,846	0%	2%	1%
<b>Total</b>	<b>435,813</b>	<b>484,772</b>	<b>920,585</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>



Table 6 shows a comparison by age group and sex of the number of deaths from the OAS database with those reported by Statistics Canada (official Vital Statistics for Canada) over the period 2005 to 2009. For ages 65 to 69, the lower number of OAS deaths compared to that of the Vital Statistics may be explained by recipient rates for OAS benefits being less than 100%. This could be due to the reason that a portion of the population does not apply for the OAS benefit by age 69 either because of not yet being eligible or opting not to receive OAS benefits. For ages 70 and above, the number of deaths from Vital Statistics is lower than that of OAS beneficiaries.

**Table 6 OAS Program versus Vital Statistics Deaths (2005-2009)**

Age Group	Males			Females		
	OAS	Vital Statistics <sup>(*)</sup>	Ratio OAS to Vital Statistics	OAS	Vital Statistics <sup>(*)</sup>	Ratio OAS to Vital Statistics
65-69	50,821	50,999	0.997	33,417	33,580	0.995
70-74	66,356	65,363	1.015	46,894	46,482	1.009
75-79	87,783	86,111	1.019	69,414	68,554	1.013
80-84	96,698	94,905	1.019	97,565	96,164	1.015
85-89	78,427	76,958	1.019	108,918	107,612	1.012
90+	55,729	54,689	1.019	128,565	126,840	1.014
65+	<b>435,813</b>	<b>429,025</b>	<b>1.016</b>	<b>484,772</b>	<b>479,232</b>	<b>1.012</b>

(\*) The number of deaths for the period 2005 to 2009 is from official Vital Statistics from Statistics Canada, Deaths database (CANSIM Table 102-0503).

## 2. Exposures

Exposures by calendar year, age and sex are derived using a seriatim approach. Exposures are defined as the number of life-years that were exposed to risk of death during the period examined.

The exposures are determined by an exact age method whereby exposure for each person is measured from the age at commencement of OAS benefits to the time of death. The exposures are then tabulated by age and sex. Fractional years were determined by attained age at each birthday and at the end of each year of the study. Each half-month is given the same weight of one twenty-fourth of a year.

Exposures by age group and sex are shown in Table 7. As females live longer than males on average, the exposures for females are distributed more toward advanced ages. Table 30 in Appendix A presents overall OAS male and female deaths and exposures by individual age.

**Table 7 Exposures (2005-2009)**

Age Group	Exposures		Distribution	
	Males	Females	Males	Females
65-69	2,976,184	3,178,119	32%	26%
70-74	2,420,065	2,717,668	26%	23%
75-79	1,929,111	2,406,307	21%	20%
80-84	1,251,517	1,920,251	13%	16%
85-89	599,020	1,185,975	6%	10%
90-94	190,005	507,074	2%	4%
95-99	35,969	135,816	0%	1%
100+	3,390	19,014	0%	0%
65+	9,405,261	12,070,224	100%	100%

The number of OAS Program beneficiaries during each of the years in the study period is shown in Table 8. The OAS Program provides a payment in the month of death, which is reflected in the number of beneficiaries shown. Table 31 in Appendix A presents the number of OAS beneficiaries in pay by individual age and sex as at each December 31 over the study period.

**Table 8 Beneficiaries in Pay (2005-2009)\***

Age at 31 <sup>st</sup> December	2005		2006		2007		2008		2009	
Age Group	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
65-69	564,141	601,223	581,565	619,208	608,020	644,552	635,616	672,174	662,181	699,534
70-74	489,202	546,984	492,244	548,054	495,312	549,941	505,753	560,231	516,349	570,458
75-79	390,941	489,818	400,736	493,849	409,732	498,236	414,234	498,131	419,283	500,148
80-84	257,740	398,835	264,631	401,897	273,103	404,879	282,494	408,820	290,160	410,455
85-89	122,250	238,238	131,318	252,268	140,587	266,931	148,884	278,120	157,314	288,994
90-94	44,533	113,847	46,448	117,578	47,972	120,633	49,655	124,063	51,423	127,947
95-99	9,118	32,357	9,501	33,957	10,209	36,248	11,065	38,638	11,850	41,189
100+	975	5,359	1,056	5,567	1,151	5,872	1,218	6,261	1,314	6,723
65+	1,878,900	2,426,661	1,927,499	2,472,378	1,986,086	2,527,292	2,048,919	2,586,438	2,109,874	2,645,448

\* Beneficiaries in pay include those who died during the year as well as those cases classified as suspended and under investigation.

### 3. Mortality Rates

#### a) 2007 Base Year Crude Mortality Rates

The resulting 2007 base year crude mortality rates by age and sex are presented in Table 9. The ratio of male to female rates is an indicator of the average shorter lifetime of males compared to females. However, although males experience a higher level of mortality, the relative gap between the two sexes narrows as mortality converges with age, which is reflected in the falling male/female mortality ratio.

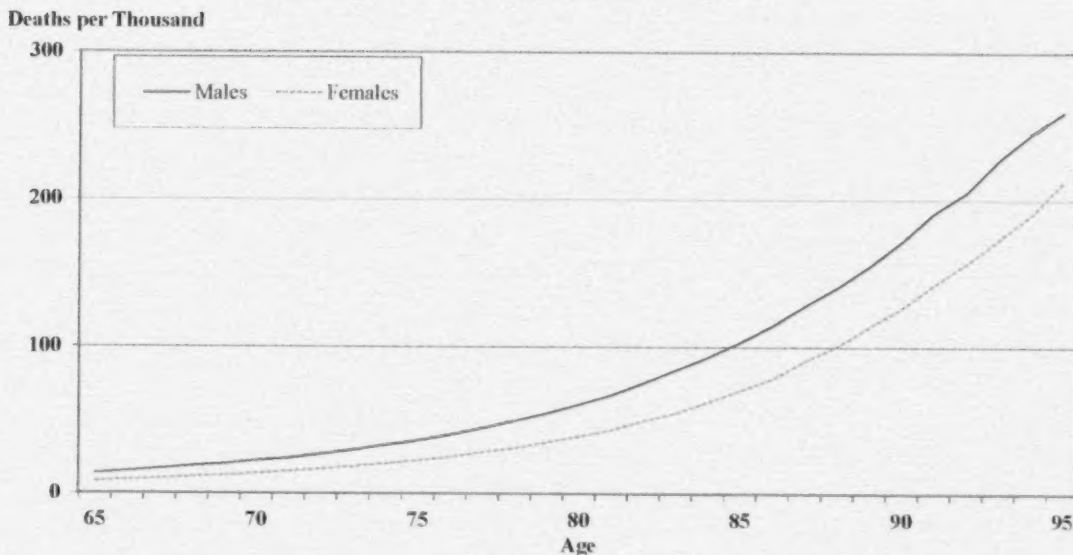
The progression of the 2007 base year crude mortality rates by age and for each sex is displayed in Chart 4. Males experience a higher level of mortality than females at all ages.

**Table 9 Crude Mortality Rates (deaths per thousand, 2007)**

Age Group	Males	Females	Ratio Males to Females
65-69	16.9	10.5	1.62
70-74	27.0	17.1	1.58
75-79	44.5	28.4	1.56
80-84	74.4	49.5	1.50
85-89	122.7	87.8	1.40
90-94	198.4	151.7	1.31
95*	259.5	212.8	1.22

\* Age 95 is the highest age with a statistically credible crude mortality rate.

**Chart 4 Crude Mortality Rates (2007)**



## b) 2007 Base Year Graduated and Extended Mortality Rates

The graduated and extended mortality rates by age and sex and the corresponding ratios of male to female rates are presented in Table 10. As noted for the crude mortality rates, males experience a higher level of mortality than females, but the relative gap between the sexes decreases with advancing age, as can be seen by the falling male/female graduated mortality ratio.

The crude mortality rates are graduated up to age 95, which was the highest age with statistically credible crude mortality rates. The graduated mortality rates are extended from age 95 to age 120 using a logistic function, since it reflects rising mortality at diminishing rates as observed at the advanced ages. The graduated and extended rates for both sexes are shown in Chart 5.

Mortality rates and other life table statistics for OAS Program beneficiaries are provided in Table 32 of Appendix A.

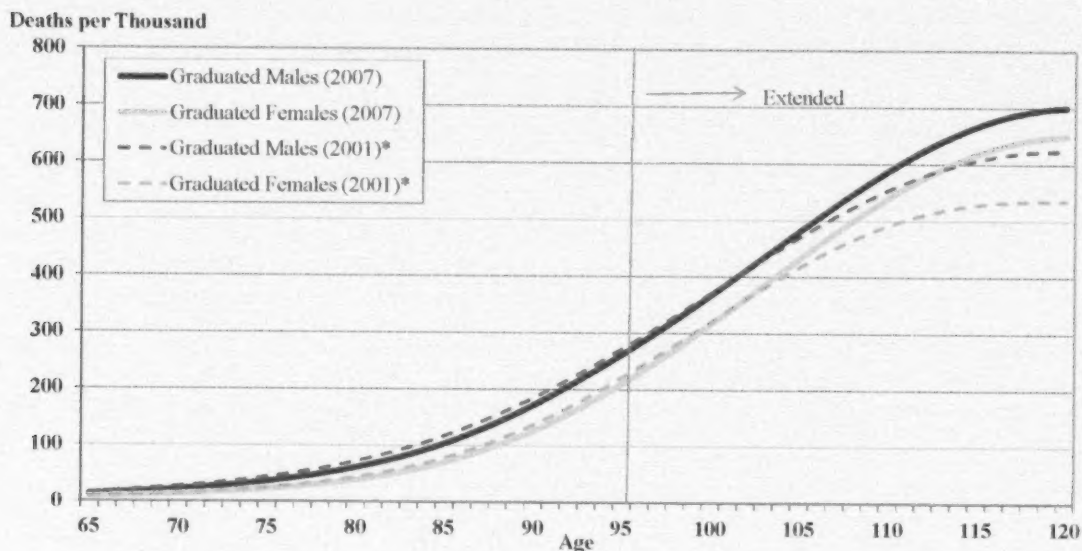
**Table 10 Graduated and Extended Mortality Rates (deaths per thousand, 2001, 2007)**

Age Group	2001*			2007		
	Males	Females	Ratio Males to Females	Males	Females	Ratio Males to Females
65-69	20.3	11.8	1.72	16.9	10.5	1.62
70-74	32.8	19.0	1.72	27.1	17.1	1.58
75-79	53.2	31.8	1.67	44.5	28.4	1.56
80-84	85.8	54.9	1.56	74.4	49.5	1.50
85-89	137.7	97.0	1.42	123.5	87.9	1.40
90-94	208.6	162.3	1.29	197.5	152.1	1.30
95-99	295.7	248.2	1.19	286.7	238.1	1.20
100-104	392.0	343.9	1.14	390.0	342.3	1.14
105-109	481.6	432.5	1.13	495.8	454.4	1.09
110-114	581.1	507.5	1.13	607.9	558.8	1.09
115-119	616.7	533.0	1.12	684.4	635.3	1.08
120	622.7	535.3	1.12	700.0	650.0	1.08

\* Data for 2001 taken from OAS Program Mortality Experience: Actuarial Study No. 5.



**Chart 5 Graduated Mortality Rates with Extension to Age 120 (2001, 2007)**



\* Data for 2001 taken from OAS Program Mortality Experience: Actuarial Study No. 5.

## B. Mortality Comparisons

In this section, mortality rates of different OAS beneficiary groups are compared by way of mortality ratios by age and sex. Mortality comparisons are made between the following groups of beneficiaries:

- (1) Overall OAS and 2007 CHMD
- (2) Born in Canada and born outside of Canada
- (3) OAS with GIS and without GIS
- (4) Married and Single with GIS and without GIS
- (5) Canada less Québec with CPP retirement pension and without CPP retirement pension.

## 1. Comparison with 2007 CHMD Mortality

Since OAS Program beneficiaries represent a large portion of the older Canadian population, the base year 2007 OAS mortality rates are compared to the CHMD mortality table for that year.

As shown in Table 11, male and female OAS Program beneficiaries experience higher mortality relative to the CHMD mortality. On average, in 2007, the overall mortality of OAS beneficiaries in Canada is 5% higher for males and 3% higher for females relative to CHMD mortality. These differences are somewhat lower than the ones observed in 2001 in the OAS Program Mortality Experience: Actuarial Study No. 5. The mortality difference is especially higher (i.e. 7%) at ages 80 and over for males whereas it is relatively constant for females. An important factor that may explain the difference is that CHMD mortality is based on a survey, while the OAS mortality is based on an administrative database.

**Table 11 Comparison of OAS Program and CHMD Mortality Rates (deaths per thousand)**

Age Group	2007					
	Males			Females		
	OAS	Benchmark*	Ratio OAS to Benchmark	OAS	Benchmark*	Ratio OAS to Benchmark
65-69	16.9	16.4	1.03	10.5	10.2	1.03
70-74	27.1	26.3	1.03	17.1	16.6	1.03
75-79	44.5	43.2	1.03	28.4	27.1	1.05
80-84	74.4	70.3	1.06	49.5	47.6	1.04
85-89	123.5	115.4	1.07	87.9	85.9	1.02
90-94	197.5	183.0	1.08	152.1	148.1	1.03
95-99	286.7	268.0	1.07	238.1	231.3	1.03
100+	394.6	367.6	1.07	349.5	340.3	1.03
65+	44.4	42.4	1.05	38.4	37.2	1.03
Age Group	2001**					
	Males			Females		
	OAS	Benchmark**	Ratio OAS to Benchmark	OAS	Benchmark**	Ratio OAS to Benchmark
65-69	20.3	19.7	1.03	11.8	11.3	1.04
70-74	32.8	31.4	1.04	19.0	18.1	1.05
75-79	53.2	49.9	1.07	31.8	30.6	1.04
80-84	85.8	79.3	1.08	54.9	52.6	1.04
85-89	137.7	123.1	1.12	97.0	90.5	1.07
90-94	208.6	185.8	1.12	162.3	150.1	1.08
95-99	295.7	279.9	1.06	248.2	232.4	1.07
100+	397.7	404.5	0.98	350.0	345.7	1.01
65+	49.1	45.8	1.07	39.8	37.7	1.06

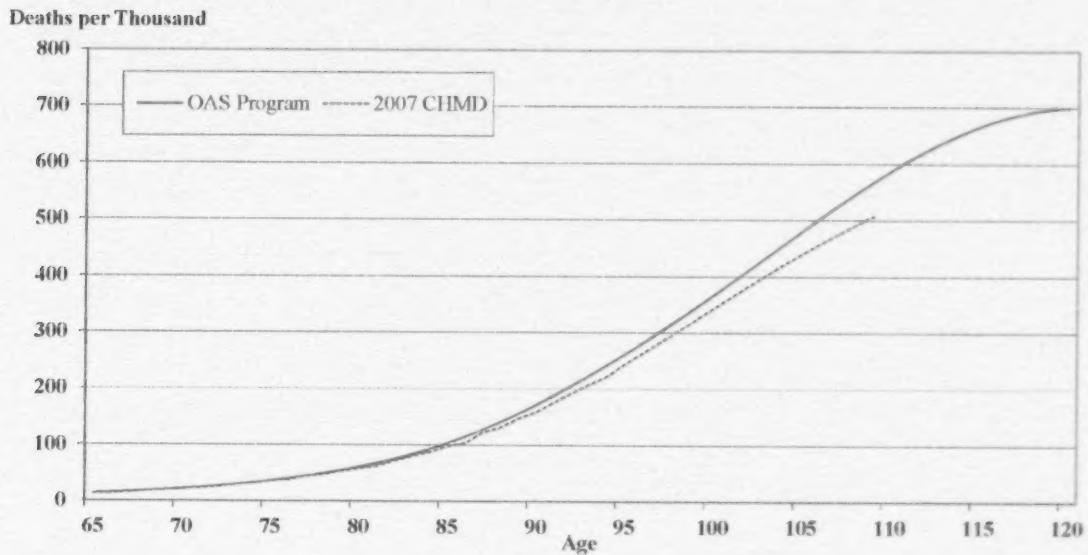
\* CHMD 2007.

\*\* Data for 2001 taken from OAS Program Mortality Experience: Actuarial Study No. 5. Benchmark is the 1995-1997 Canada Life Table projected to 2001 using mortality improvements from 1996 to 2001.

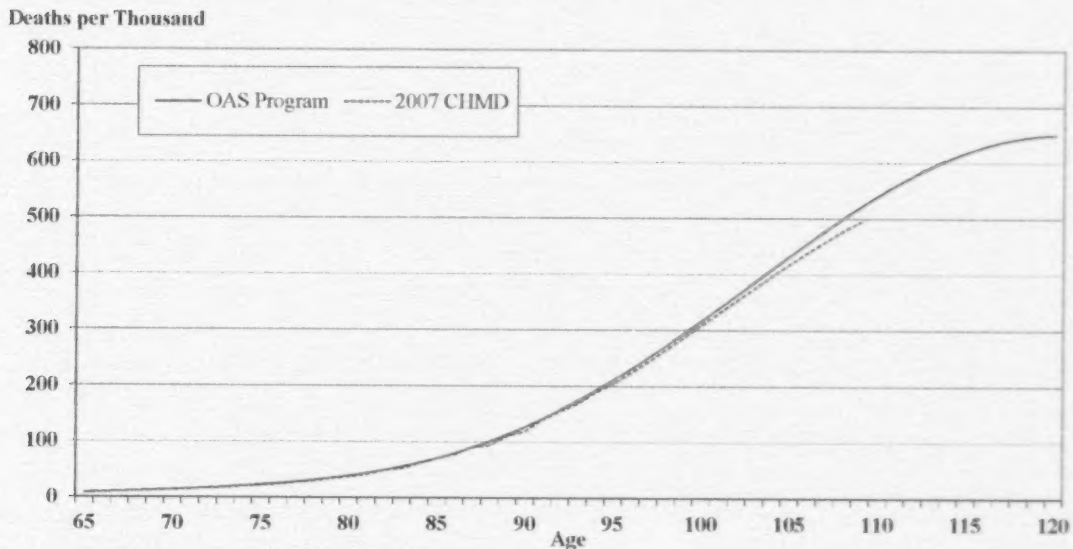
The graphs of OAS and CHMD mortality rates for males and females for the year 2007 are shown below in Chart 6. For both sexes, the CHMD mortality curves are flatter than the OAS mortality curves after age 80, and the difference is more pronounced after age 100.

**Chart 6 Comparison of OAS Program and CHMD Mortality Rates (2007)**

**Males**



**Females**



## 2. Comparison Between Those Born in Canada and Immigrants

Immigration to Canada has historically been volatile. However, historical levels have been relatively high as a percentage of the general population. Moreover, as the total fertility rate has fallen significantly since the late 1950s to below replacement level, immigration has represented an increasing portion of the growth of the Canadian population over time. The number of life-years of exposure by place of birth is shown in Table 12. The proportion of those born outside Canada increases significantly for ages 95 and older. Tables 33 and 34 in Appendix A present the number of deaths and level of exposures, respectively by individual age, sex, and place of birth.

**Table 12 Exposures by Place of Birth (2005-2009)**

Age Group	Males				Females			
	Born in Canada	Born Outside of Canada	Overall OAS	Proportion Born Outside of Canada	Born in Canada	Born Outside of Canada	Overall OAS	Proportion Born Outside of Canada
65-69	2,126,518	849,666	2,976,184	29%	2,295,206	882,913	3,178,119	28%
70-74	1,685,458	734,607	2,420,065	30%	1,949,075	768,593	2,717,668	28%
75-79	1,333,943	595,168	1,929,111	31%	1,734,756	671,550	2,406,307	28%
80-84	854,367	397,150	1,251,517	32%	1,352,125	568,126	1,920,251	30%
85-89	421,921	177,100	599,020	30%	879,850	306,125	1,185,975	26%
90-94	136,064	53,940	190,005	28%	385,564	121,509	507,074	24%
95-99	19,693	16,276	35,969	45%	80,627	55,189	135,816	41%
100+	1,135	2,254	3,390	67%	7,155	11,859	19,014	62%
65+	6,579,098	2,826,162	9,405,260	30%	8,684,359	3,385,865	12,070,224	28%

As presented in Table 13 and illustrated in Chart 7, immigrants experience lower mortality than those born in Canada. As such, immigrants have contributed to increasing life expectancies in Canada. The greater life expectancies of immigrants as well as their relative better health compared to those born in Canada may be explained by a "healthy immigrant effect" as discussed by Ng<sup>1</sup>. Several factors contribute to better immigrant mortality. First, all potential immigrants to Canada are subject to medical screening. Moreover, immigrants to Canada are partially selected on the basis of employability, which would imply a certain status of health. As new immigrants tend to be in better health, they could experience greater life expectancies than those who had immigrated years earlier. Lastly, cultural and lifestyle characteristics of immigrants may also contribute to their relative better health and increased longevity. Tables 35 and 36 in Appendix A present the mortality rates and mortality ratios, respectively by individual age, sex, and place of birth. Tables 37 and 38 in Appendix A present the life tables for these subgroups.

<sup>1</sup> Chen, J., R. Wilkins, and E. Ng. 1996. *Health Expectancy by Immigrant Status, 1986 and 1991*. Health Reports. Statistics Canada. 8(3): 29-38.



**Table 13 Mortality Rates by Place of Birth (deaths per thousand)**

2007										
Age Group	Males					Females				
	Overall OAS	Born in Canada	Ratio Born in Canada to Overall OAS	Born Outside of Canada	Ratio Born Outside of Canada to Overall OAS	Overall OAS	Born in Canada	Ratio Born in Canada to Overall OAS	Born Outside of Canada	Ratio Born Outside of Canada to Overall OAS
65-69	16.9	18.6	1.10	12.8	0.76	10.5	11.7	1.11	7.4	0.71
70-74	27.1	29.4	1.09	21.6	0.80	17.1	18.8	1.10	12.8	0.75
75-79	44.5	47.5	1.07	37.8	0.85	28.4	30.2	1.06	23.9	0.84
80-84	74.4	78.2	1.05	66.2	0.89	49.5	51.4	1.04	44.9	0.91
85-89	123.5	128.4	1.04	111.5	0.90	87.9	90.1	1.02	81.6	0.93
90-94	197.5	202.3	1.02	185.3	0.94	152.1	153.6	1.01	147.7	0.97
95-99	286.7	291.0	1.01	278.6	0.97	238.1	235.5	0.99	241.1	1.01
100+	394.6	402.9	1.02	386.7	0.98	349.5	347.6	0.99	352.7	1.01

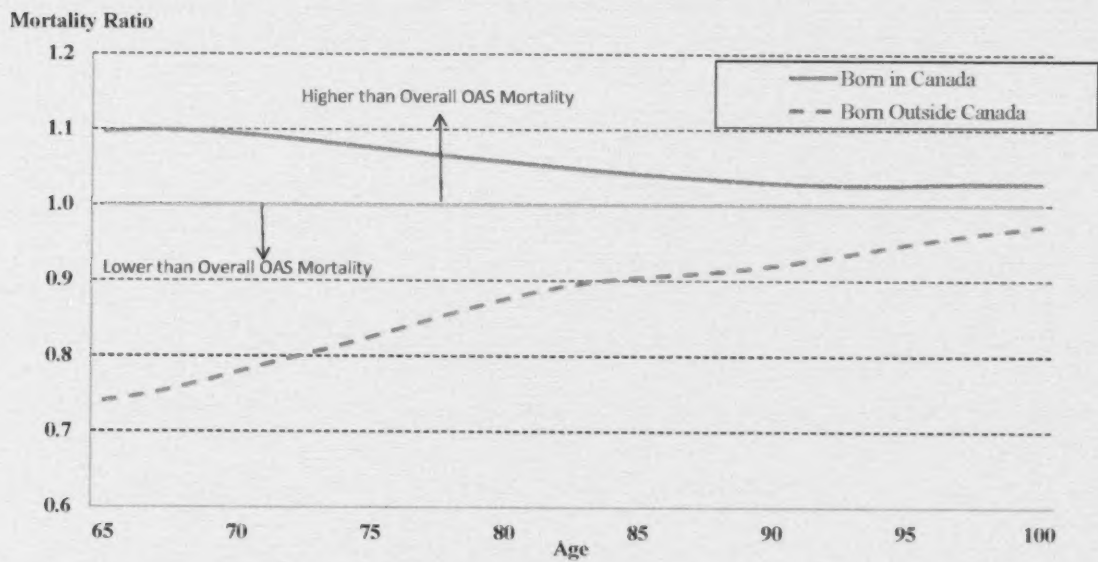
  

2001*										
Age Group	Males					Females				
	Overall OAS	Born in Canada	Ratio Born in Canada to Overall OAS	Born Outside of Canada	Ratio Born Outside of Canada to Overall OAS	Overall OAS	Born in Canada	Ratio Born in Canada to Overall OAS	Born Outside of Canada	Ratio Born Outside of Canada to Overall OAS
65-69	20.3	22.1	1.09	15.7	0.77	11.8	12.9	1.09	8.7	0.73
70-74	32.8	35.2	1.07	26.9	0.82	19.0	20.2	1.06	15.6	0.82
75-79	53.2	56.1	1.06	46.0	0.86	31.8	33.2	1.04	28.1	0.88
80-84	85.8	89.4	1.04	75.4	0.88	54.9	56.2	1.02	50.5	0.92
85-89	137.7	141.2	1.03	128.7	0.93	97.0	98.0	1.01	94.4	0.97
90-94	208.6	211.2	1.01	204.6	0.98	162.3	161.8	1.00	162.3	1.00
95-99	295.7	302.5	1.02	292.9	0.99	248.2	253.8	1.02	245.3	0.99
100+	397.7	399.5	1.00	395.6	0.99	350.0	360.4	1.03	344.6	0.98

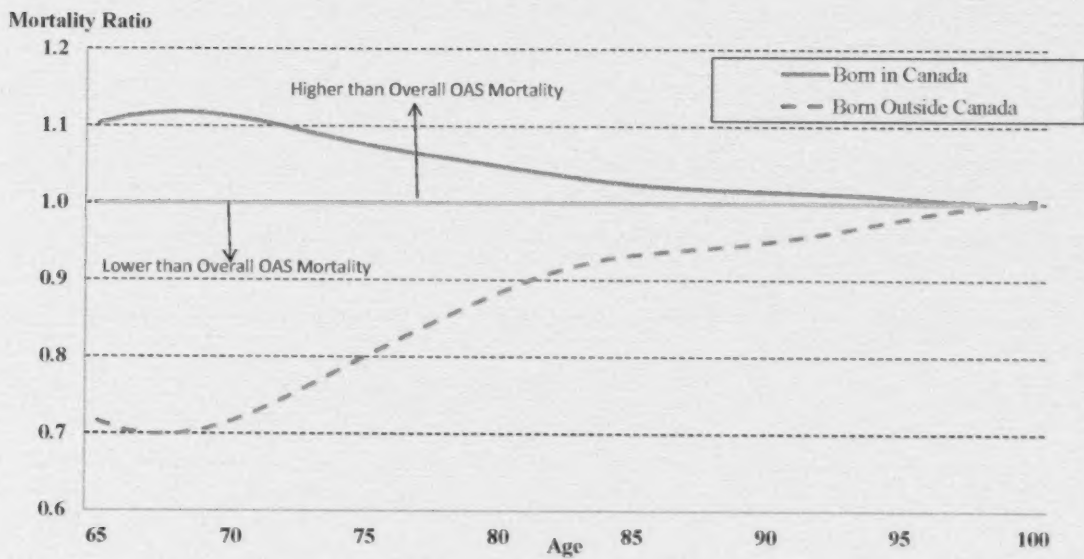
\* Data for 2001 taken from OAS Program Mortality Experience: Actuarial Study No. 5.

**Chart 7 Mortality Ratios by Place of Birth (2007)**

**Males**



**Females**



### 3. Comparison by Type of Benefit

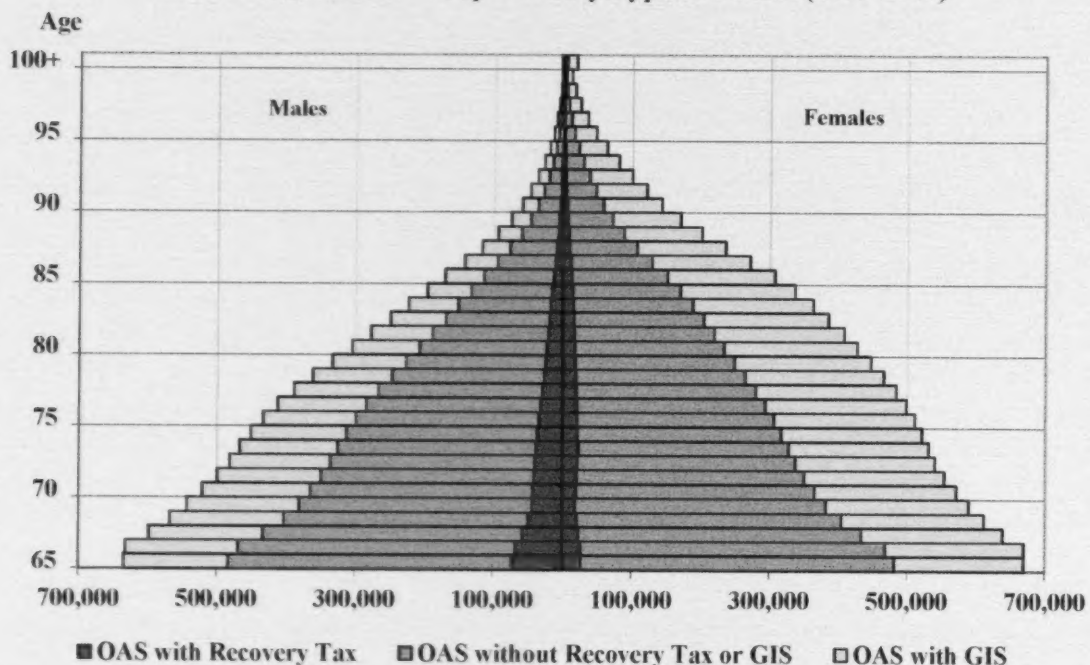
#### a) Distribution of Exposures

The age and sex structure of the amount of exposures by type of OAS benefit received over the period from 2005 to 2009 is displayed in Chart 8. The total exposures for females exceed that for males, and this is especially evident at the older ages. This difference is indicative of life expectancies for females being greater than for males.

Consistent with the fact that males generally have higher levels of income than females, the proportion of exposures during which males received OAS pensions without the GIS was higher than the corresponding proportion for females. For instance, at age 65 the proportion of males (in terms of life-years of exposure) receiving OAS pensions without GIS benefits was 76% compared to 72% for females. In comparison, at age 80 the proportion of males receiving OAS pensions without GIS benefits was 68% compared to 55% for females.

The mortality experience of those beneficiaries subject to the Repayment provision was not considered in this study because of the corresponding low amount of exposure. For this group, the level of exposure was less than 6% of the total exposure and only 4% for those aged 90 or older.

**Chart 8 Distribution of Exposures by Type of Benefit (2005-2009)**



## b) OAS without GIS

The proportion of those OAS beneficiaries who were not receiving the GIS benefit at the time of death generally decreases with age as shown in Table 14. This is explained by the general trend that as older ages are reached net income tends to decrease, which leads to an increased likelihood of receiving the GIS. Table 39 in Appendix A presents the number of deaths by individual age and sex for this subgroup.

The proportion of male OAS beneficiaries who were not receiving the GIS benefit at the time of death decreases from 59% for those in the age group 65 to 69 to 41% for those aged 100 and over. For females, the corresponding proportion decreases from 56% to 26% over the same age range.

**Table 14 Without GIS Beneficiary Deaths (2005-2009)**

Age Group	Males			Females		
	Overall OAS	without GIS	Proportion without GIS	Overall OAS	without GIS	Proportion without GIS
65-69	50,821	30,182	59%	33,417	18,619	56%
70-74	66,356	39,108	59%	46,894	24,418	52%
75-79	87,783	53,691	61%	69,414	34,368	50%
80-84	96,698	61,451	64%	97,565	46,122	47%
85-89	78,427	49,474	63%	108,918	46,658	43%
90-94	42,003	24,033	57%	83,436	30,587	37%
95-99	12,053	5,907	49%	36,958	11,470	31%
100+	1,674	693	41%	8,172	2,088	26%
65+	435,813	264,536	61%	484,772	214,330	44%

The number of life-years of exposure for those not receiving the GIS benefit in comparison to the overall amount of exposure for OAS beneficiaries is shown in Table 15. The proportion of exposures for females not receiving GIS benefits is significantly lower than that for males at all age groups, especially at ages 75 and above. This is attributable to the fact that women receive less income than men, which is linked to the historical lower participation of women in the workforce. However, labour force participation rates for females have significantly increased recently, and it is projected that the male-female participation gap will further narrow over the long term.

For males, the proportion of exposures for those not receiving GIS benefits remains relatively steady for age groups between 65 and 89 and then decreases to 42% for those aged 100 and over. For females, the corresponding proportion decreases to a greater extent through all age groups, from 68% for those aged 65 to 69 to 26% for those aged 100 and over. Table 40 in Appendix A presents OAS the level of exposures by individual age and sex for this subgroup.



**Table 15 Without GIS Beneficiary Exposures (2005-2009)**

Age Group	Males			Females		
	Overall OAS	without GIS	Proportion without GIS	Overall OAS	without GIS	Proportion without GIS
65-69	2,976,184	2,167,947	73%	3,178,119	2,170,727	68%
70-74	2,420,065	1,686,877	70%	2,717,668	1,699,000	63%
75-79	1,929,111	1,323,115	69%	2,406,307	1,393,961	58%
80-84	1,251,517	848,755	68%	1,920,251	1,016,049	53%
85-89	599,020	392,894	66%	1,185,975	547,492	46%
90-94	190,005	111,470	59%	507,074	194,089	38%
95-99	35,969	17,911	50%	135,816	43,301	32%
100+	3,390	1,434	42%	19,014	5,019	26%
65+	9,405,260	6,550,403	70%	12,070,224	7,069,637	59%

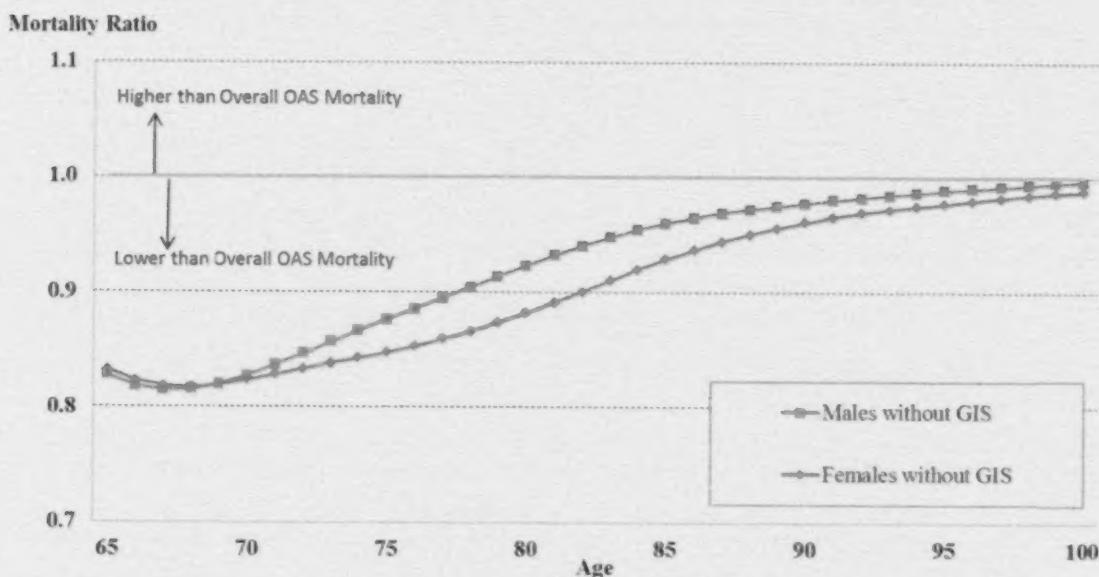
A comparison of the mortality rates between those who do not receive the GIS and all OAS beneficiaries is shown in Table 16 and Chart 9. Those beneficiaries who do not receive the GIS experience lower mortality compared to all OAS beneficiaries collectively. However, the subgroup rates approach the overall level as age increases, as shown by the increasing mortality ratios for both males and females. Tables 41 and 42 in Appendix A present mortality rates and mortality ratios, respectively by individual age and sex for this subgroup. Table 43 in Appendix A presents the life table for those who do not receive the GIS benefit.

**Table 16 Mortality Rates of Beneficiaries Not Receiving the GIS (deaths per thousand)**

2007						
Age Group	Males			Females		
	Overall OAS	without GIS	Ratio without GIS to Overall OAS	Overall OAS	without GIS	Ratio without GIS to Overall OAS
65-69	16.9	13.8	0.82	10.5	8.6	0.82
70-74	27.1	22.9	0.85	17.1	14.2	0.83
75-79	44.5	39.8	0.89	28.4	24.4	0.86
80-84	74.4	69.9	0.94	49.5	44.4	0.90
85-89	123.5	119.0	0.96	87.9	82.1	0.93
90-94	197.5	192.9	0.98	152.1	146.1	0.96
95-99	286.7	282.7	0.99	238.1	232.2	0.98
100+	394.6	392.5	0.99	349.5	343.4	0.98
2001 *						
Age Group	Males			Females		
	Overall OAS	without GIS	Ratio without GIS to Overall OAS	Overall OAS	without GIS	Ratio without GIS to Overall OAS
65-69	20.3	17.0	0.84	11.8	9.7	0.82
70-74	32.8	28.6	0.87	19.0	15.8	0.83
75-79	53.2	48.3	0.91	31.8	27.3	0.86
80-84	85.8	79.5	0.93	54.9	48.7	0.89
85-89	137.7	130.4	0.95	97.0	89.7	0.92
90-94	208.6	200.1	0.96	162.3	154.1	0.95
95-99	295.7	288.6	0.98	248.2	239.8	0.97
100+	397.7	395.4	0.99	350.0	346.3	0.99

\* Data for 2001 taken from OAS Program Mortality Experience: Actuarial Study No. 5.

**Chart 9 Mortality Ratios of Beneficiaries Not Receiving the GIS (2007)**



**c) OAS with GIS**

The proportion of all OAS beneficiaries who were receiving the GIS benefit at the time of death generally increases with age, as shown in Table 17. This is explained by the general trend that as older ages are reached net income tends to decrease, which leads to an increased likelihood of receiving the GIS.

The proportion of male OAS beneficiaries who were receiving the GIS benefit at the time of death increases overall from 41% for those in the age group 65 to 69 to 59% for those aged 100 and over. For females, the corresponding proportion increases from 44% to 74% over the same age range.

**Table 17 GIS Beneficiary Deaths (2005-2009)**

Age Group	Males			Females		
	OAS Beneficiaries	with GIS	Proportion with GIS	OAS Beneficiaries	with GIS	Proportion with GIS
65-69	50,821	20,640	41%	33,417	14,798	44%
70-74	66,356	27,248	41%	46,894	22,476	48%
75-79	87,783	34,092	39%	69,414	35,046	50%
80-84	96,698	35,247	36%	97,565	51,443	53%
85-89	78,427	28,953	37%	108,918	62,260	57%
90-94	42,003	17,970	43%	83,436	52,849	63%
95-99	12,053	6,146	51%	36,958	25,488	69%
100+	1,674	982	59%	8,172	6,084	74%
65+	435,813	171,277	39%	484,772	270,442	56%

A comparison of exposures between those receiving the GIS benefit and the overall level for OAS beneficiaries is shown in Table 18. The proportion of exposures for female GIS recipients is significantly greater than for males at all age groups, especially at ages 70 and above. This is attributable to the fact that women generally receive less income than men, as discussed earlier regarding the lower proportion of exposures for females without the GIS compared to males.

**Table 18 GIS Beneficiary Exposures (2005-2009)**

Age Group	Males			Females		
	Overall OAS	with GIS	Proportion with GIS	Overall OAS	with GIS	Proportion with GIS
65-69	2,976,184	808,236	27%	3,178,119	1,007,392	32%
70-74	2,420,065	733,187	30%	2,717,668	1,018,668	37%
75-79	1,929,111	605,996	31%	2,406,307	1,012,346	42%
80-84	1,251,517	402,762	32%	1,920,251	904,202	47%
85-89	599,020	206,127	34%	1,185,975	638,484	54%
90-94	190,005	78,535	41%	507,074	312,985	62%
95-99	35,969	18,058	50%	135,816	92,515	68%
100+	3,390	1,956	58%	19,014	13,995	74%
65+	9,405,260	2,854,858	30%	12,070,224	5,000,587	41%

For males, the proportion of exposures for GIS recipients remains relatively steady for age groups between 65 and 84 and then increases to 58% for those aged 100 and over. For females, the corresponding proportion increases to a greater extent, from 32% for those aged 65 to 69 to 74% for those aged 100 and over.

For both sexes in the age group 65 to 69, the proportion of exposures for GIS recipients is significantly less than the proportion of deaths, which reflects the higher level of mortality of GIS recipients for that age group. The difference between the proportions declines with age. For those aged 100 and older, exposure and death proportions are close to equal.

The mortality rates and mortality ratios of those who receive the GIS benefit are shown in Table 19. For each sex, mortality ratios decrease and converge to a value of one as the mortality rates converge to the overall Program rates at the advanced ages. Mortality ratios for those not in receipt of the GIS are also shown in Chart 10 for comparison.

Table 44 in Appendix A presents the life table for those who receive the GIS benefit.

**Table 19 GIS Beneficiary Mortality Rates (deaths per thousand)**

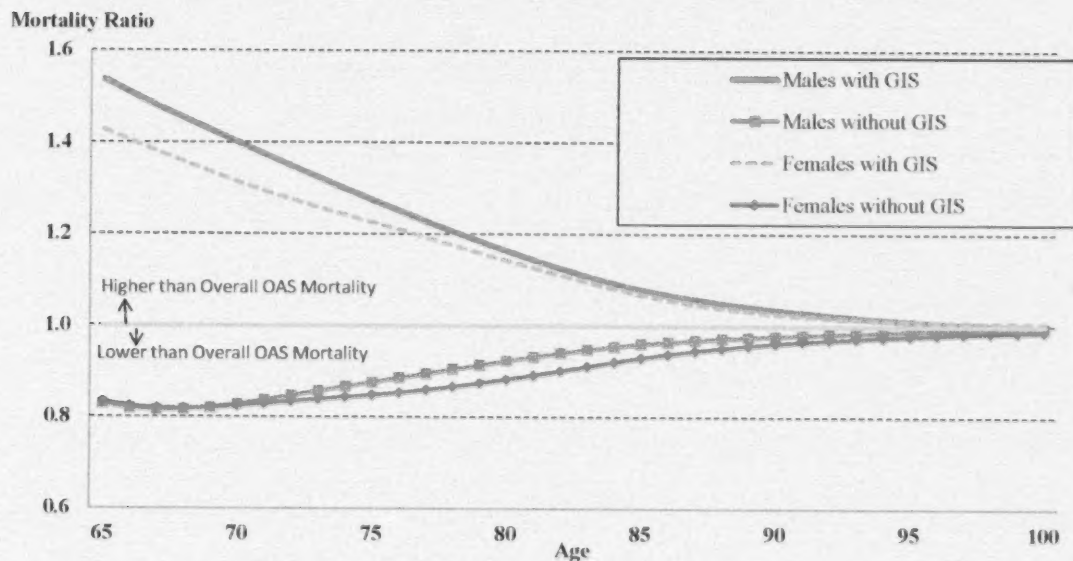
2007						
Age Group	Males			Females		
	Overall OAS	with GIS	Ratio with GIS to Overall OAS	Overall OAS	with GIS	Ratio with GIS to Overall OAS
65-69	16.9	25.2	1.49	10.5	14.6	1.39
70-74	27.1	36.4	1.34	17.1	21.8	1.27
75-79	44.5	54.6	1.23	28.4	34.0	1.20
80-84	74.4	83.8	1.13	49.5	55.2	1.12
85-89	123.5	131.9	1.07	87.9	92.9	1.06
90-94	197.5	203.8	1.03	152.1	155.7	1.02
95-99	286.7	290.0	1.01	238.1	240.9	1.01
100+	394.6	394.0	1.00	349.5	352.3	1.01

2001*						
Age Group	Males			Females		
	Overall OAS	with GIS	Ratio with GIS to Overall OAS	Overall OAS	with GIS	Ratio with GIS to Overall OAS
65-69	20.3	28.6	1.41	11.8	16.3	1.38
70-74	32.8	43.3	1.32	19.0	24.7	1.30
75-79	53.2	65.3	1.23	31.8	38.1	1.20
80-84	85.8	99.0	1.15	54.9	61.3	1.12
85-89	137.7	148.9	1.08	97.0	102.6	1.06
90-94	208.6	218.0	1.05	162.3	166.8	1.03
95-99	295.7	301.6	1.02	248.2	252.0	1.02
100+	397.7	397.7	1.00	350.0	353.3	1.01

\* Data for 2001 taken from OAS Program Mortality Experience: Actuarial Study No. 5.

**Chart 10 Mortality Ratios of Beneficiaries by Receipt of the GIS (2007)**





#### 4. Comparison by Marital Status and Type of Benefit

##### a) Distribution of Exposures

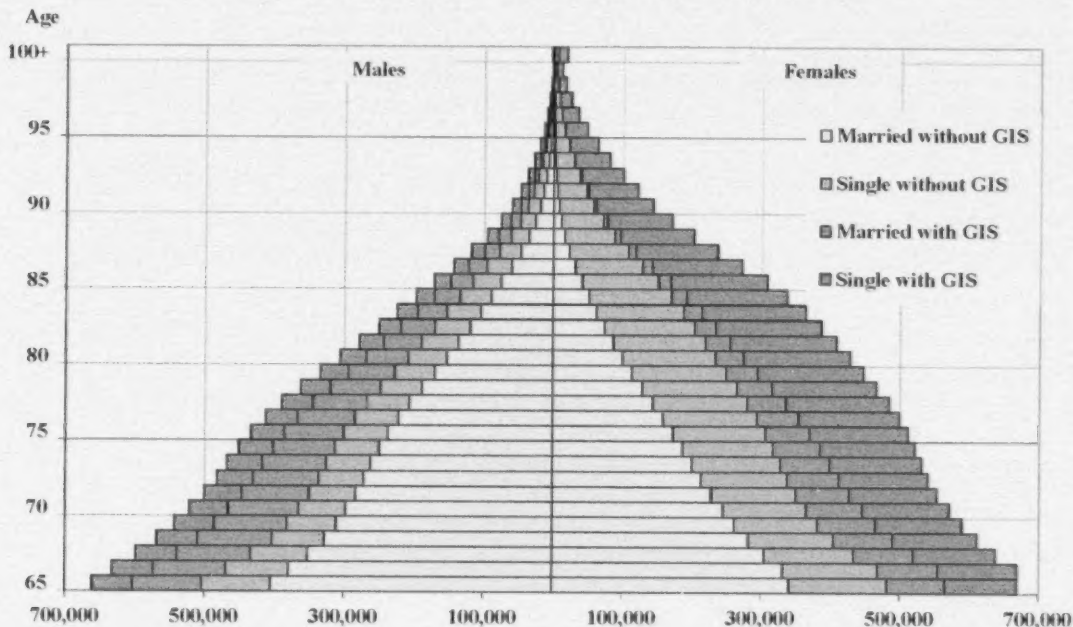
The age and sex structure of the amount of exposures by marital status and type of benefit received over the period from 2005 to 2009 is displayed in Chart 11. Table 20 shows that the proportions of single beneficiaries (in terms of exposures) for those with and without the GIS increase with age (and the proportions of married individuals likewise decrease) as married individuals become single upon the death of their spouses.

There is a significant difference between the sexes in the distribution of exposures by age and marital status. For example, for the age group 65 to 69, the proportion of exposures in respect of married male beneficiaries not in receipt of GIS benefits is 81%, while for females the corresponding proportion is 70%. For the age group 85 to 89, these proportions are 61% for males and 23% for females.

For the age group 65 to 69, the proportion of exposures in respect of single male beneficiaries in receipt of GIS benefits is 36%, while for females the corresponding proportion is 58%. For the age group 85 to 89, these proportions are 46% for males and 91% for females.

Tables 45 and 46 in Appendix A show the number of beneficiaries and level of exposures, respectively by individual age, sex, and marital status. Tables 51 and 52 in Appendix A show the number of beneficiaries and level of exposures, respectively by individual age, sex, marital status, and type of benefit.

**Chart 11 Exposures by Age, Sex, Marital Status, and Type of Benefit (2005-2009)**



**Table 20 Exposures by Age, Sex, Marital Status, and Type of Benefit (2005-2009)**

Age Group	Males									
	Overall OAS		Without GIS				With GIS			
	Married	Single	Married	Single	% Married	% Single	Married	Single	% Married	% Single
65-69	2,271,713	704,470	1,755,548	412,399	81%	19%	516,165	292,071	64%	36%
70-74	1,832,429	587,636	1,361,042	325,835	81%	19%	471,387	261,801	64%	36%
75-79	1,403,555	525,556	1,020,419	302,697	77%	23%	383,136	222,860	63%	37%
80-84	839,391	412,126	596,759	251,995	70%	30%	242,632	160,131	60%	40%
85-89	349,985	249,035	238,781	154,113	61%	39%	111,204	94,922	54%	46%
90-94	85,925	104,080	52,908	58,562	47%	53%	33,017	45,518	42%	58%
95-99	11,230	24,739	6,038	11,873	34%	66%	5,193	12,865	29%	71%
100+	591	2,798	264	1,170	18%	82%	328	1,628	17%	83%
<b>65+</b>	<b>6,794,820</b>	<b>2,610,441</b>	<b>5,031,758</b>	<b>1,518,645</b>	<b>77%</b>	<b>23%</b>	<b>1,763,062</b>	<b>1,091,796</b>	<b>62%</b>	<b>38%</b>
Age Group	Females									
	Overall OAS		Without GIS				With GIS			
	Married	Single	Married	Single	% Married	% Single	Married	Single	% Married	% Single
65-69	1,946,218	1,231,901	1,521,191	649,535	70%	30%	425,026	582,366	42%	58%
70-74	1,445,080	1,272,588	1,074,687	624,313	63%	37%	370,393	648,275	36%	64%
75-79	994,314	1,411,993	718,677	675,283	52%	48%	275,636	736,710	27%	73%
80-84	531,076	1,389,176	376,303	639,746	37%	63%	154,772	749,430	17%	83%
85-89	181,691	1,004,284	124,832	422,660	23%	77%	56,859	581,625	9%	91%
90-94	33,726	473,348	22,191	171,898	11%	89%	11,535	301,450	4%	96%
95-99	3,506	132,309	2,286	41,015	5%	95%	1,220	91,294	1%	99%
100+	135	18,879	96	4,923	2%	98%	39	13,956	0%	100%
<b>65+</b>	<b>5,135,746</b>	<b>6,934,478</b>	<b>3,840,264</b>	<b>3,229,372</b>	<b>54%</b>	<b>46%</b>	<b>1,295,481</b>	<b>3,705,106</b>	<b>26%</b>	<b>74%</b>

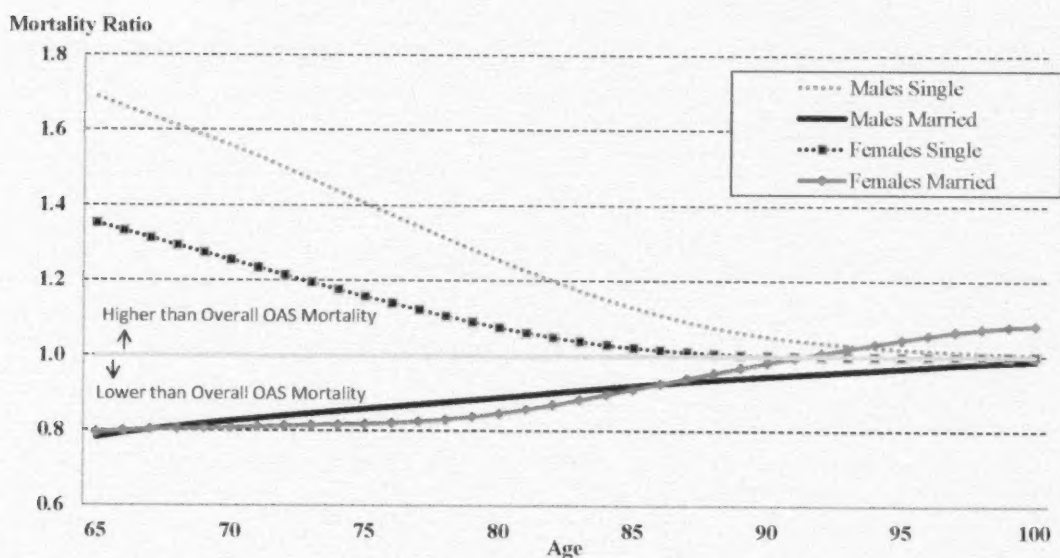
## b) Comparison by Marital Status

Table 21 and Chart 12 show a comparison of mortality experience by marital status, sex, and age group. Married males experience significantly lower mortality than single males at all ages; however, married females experience lower mortality than single females only up to age 91. The fact that married females experience higher mortality than single females at the very advanced ages may be related to the low volume of exposures and corresponding statistical volatility in mortality rates at those ages. Further investigation is needed to determine the causes of the relative change in the rates.

**Table 21 Mortality Rates by Age, Sex, and Marital Status (deaths per thousand, 2007)**

Age Group	Males					Females				
	Overall OAS	Married	Ratio Married to Overall	Single	Ratio Single to Overall	Overall OAS	Married	Ratio Married to Overall	Single	Ratio Single to Overall
65-69	16.9	13.6	0.80	27.6	1.63	10.5	8.4	0.80	13.8	1.31
70-74	27.1	22.7	0.84	40.5	1.50	17.1	13.8	0.81	20.8	1.22
75-79	44.5	38.6	0.87	59.9	1.35	28.4	23.1	0.81	32.1	1.13
80-84	74.4	66.7	0.90	89.9	1.21	49.5	42.0	0.85	52.4	1.06
85-89	123.5	113.9	0.92	136.7	1.11	87.9	79.4	0.90	89.5	1.02
90-94	197.5	186.1	0.94	206.8	1.05	152.1	147.1	0.97	152.4	1.00
95-99	286.7	275.9	0.96	292.4	1.02	238.1	243.1	1.02	238.1	1.00
100+	394.6	386.5	0.98	396.2	1.00	349.5	367.6	1.05	349.7	1.00

**Chart 12 Mortality Ratios by Age, Sex, and Marital Status (2007)**



For the age group 65 to 69, married males experience mortality that is 20% lower than the overall male beneficiary mortality level. This percentage decreases with age, reaching a level of 2% lower than the overall mortality level for those aged 100 or older. Single males experience mortality that is 63% higher than the overall level for the age group 65 to 69, and this percentage reduces to zero at the advanced ages.

For the age group 65 to 69, married females experience mortality that is 20% lower than the overall female beneficiary mortality level. This percentage decreases with age. For married females 100 and older, their mortality is 5% higher than the overall level. Single females experience mortality that is 31% higher than the overall level for the age group 65 to 69, but this group's mortality converges to the overall mortality at advanced ages.

Tables 47 and 48 in Appendix A show mortality rates and mortality ratios, respectively by individual age, sex, and marital status. Tables 49 and 50 in Appendix A show the life tables for married and single beneficiaries, respectively for males and females.

### c) Comparison by Marital Status and Type of Benefit

#### Males

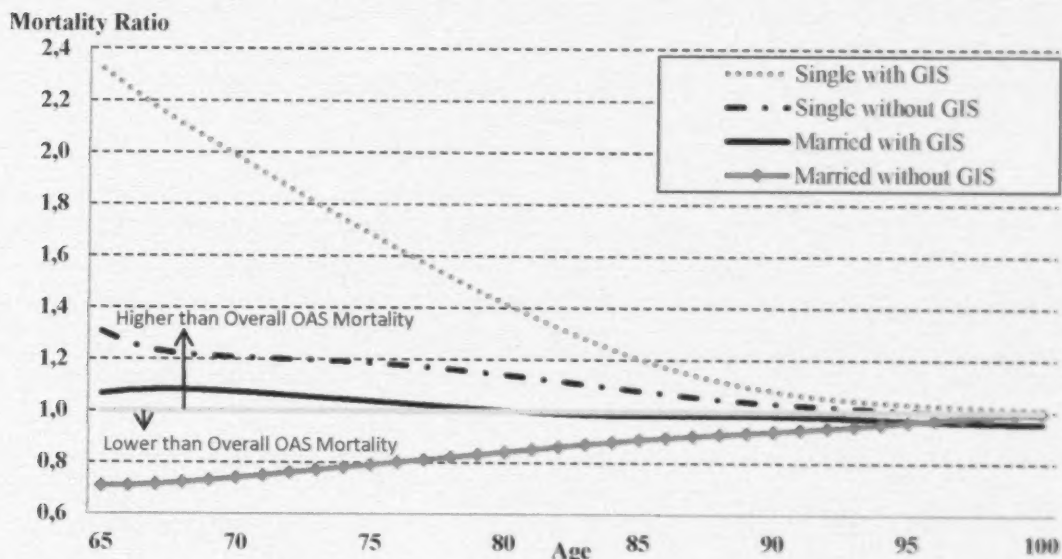
Table 22 and Chart 13 show a comparison of male mortality rates by age, marital status and type of benefit. Single males in receipt of the GIS experience the highest mortality at all ages. Those in the age group 65 to 69 experience a mortality ratio of 2.18 (i.e., a mortality rate that is more than two times the overall level) which rapidly converges to the overall mortality with advancing age. Single males not in receipt of the GIS experience mortality that is lower than for single GIS beneficiaries but higher than for married beneficiaries. Married males in receipt of GIS benefits experience mortality that is higher than the overall level up to age 80. Married males not in receipt of GIS benefits experience the lowest mortality, which shows convergence to the overall level.

**Table 22 Male Mortality Rates by Age, Marital Status, and Type of Benefit**  
 (deaths per thousand, 2007)

Age Group	Overall OAS	without GIS				with GIS			
		Married	Ratio Married to Overall	Single	Ratio Single to Overall	Married	Ratio Married to Overall	Single	Ratio Single to Overall
65-69	16.9	12.1	0.72	21.0	1.24	18.5	1.09	37.0	2.18
70-74	27.1	20.6	0.76	32.6	1.21	28.7	1.06	50.2	1.86
75-79	44.5	36.0	0.81	52.5	1.18	45.6	1.02	69.9	1.57
80-84	74.4	63.8	0.86	84.1	1.13	73.6	0.99	98.9	1.33
85-89	123.5	110.2	0.89	132.3	1.07	121.5	0.98	143.9	1.16
90-94	197.5	182.0	0.92	203.0	1.03	192.4	0.97	211.8	1.07
95-99	286.7	274.4	0.96	287.5	1.00	274.2	0.96	296.3	1.03
100+	394.6	389.7	0.99	391.1	0.99	373.6	0.95	399.2	1.01



**Chart 13 Male Mortality Ratios by Age, Marital Status, and Type of Benefit (2007)**



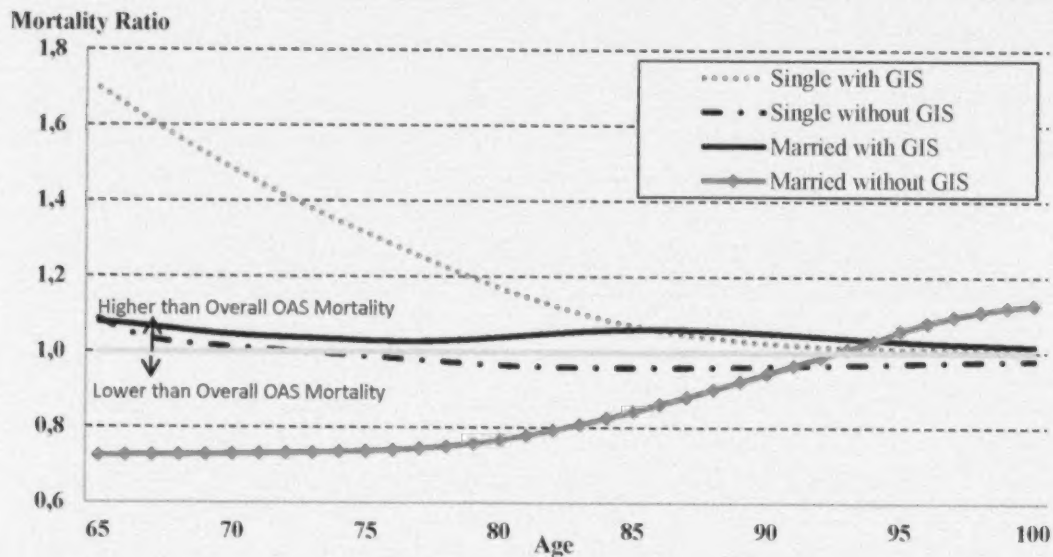
### Females

Table 23 and Chart 14 show a comparison of female mortality by age, marital status, and type of benefit. Females experience lower mortality than males for each subgroup. Single females in receipt of GIS benefits experience the highest mortality at all ages except the oldest, where mortality rates are highest for married females not in receipt of GIS benefits. As discussed earlier, this would require further investigation to determine the possible causes. Single females, aged 65 to 69 who receive the GIS experience mortality that is 62% higher than the overall level. In comparison, married females aged 65 to 69 not in receipt of GIS benefits experience the lowest mortality at 28% lower than the overall level.

**Table 23 Female Mortality Rates by Age, Marital Status, and Type of Benefit (deaths per thousand, 2007)**

Age Group	Overall OAS	without GIS				with GIS			
		Married	Ratio Married to Overall	Single	Ratio Single to Overall	Married	Ratio Married to Overall	Single	Ratio Single to Overall
65-69	10.5	7.6	0.72	10.9	1.04	11.2	1.07	17.0	1.62
70-74	17.1	12.4	0.73	17.3	1.01	17.7	1.03	24.2	1.42
75-79	28.4	20.9	0.74	28.0	0.99	29.0	1.02	35.8	1.26
80-84	49.5	38.4	0.77	47.9	0.97	50.8	1.03	56.1	1.13
85-89	87.9	74.2	0.84	84.4	0.96	90.4	1.03	93.2	1.06
90-94	152.1	143.5	0.94	146.5	0.96	153.7	1.01	155.7	1.02
95-99	238.1	246.4	1.03	231.0	0.97	236.0	0.99	241.1	1.01
100+	349.5	381.5	1.09	340.9	0.98	340.1	0.97	352.9	1.01

**Chart 14 Female Mortality Ratios by Age, Marital Status, and Type of Benefit (2007)**



Tables 53 to 58 in Appendix A show mortality rates, mortality ratios and life tables by individual age, sex, marital status, and type of benefit.

## 5. Comparison by Receipt of CPP Retirement Pension

### a) Canada less Québec Residents with and without a CPP Retirement Pension

For OAS beneficiaries residing in Canada outside of Québec and receiving a CPP retirement pension, mortality ratios generally increase with age, except at the very advanced ages for both sexes (see Table 24 and Chart 15). Male mortality rates start below overall male OAS rates, but eventually exceed them, whereas female rates remain below or at their overall rates and show a slightly greater relative increase.

For OAS beneficiaries residing in Canada less Québec and not receiving a CPP retirement pension, mortality ratios generally decrease with age, especially for males. For the age group 65 to 69, males not receiving a CPP retirement pension experience mortality that is 37% higher than the overall male mortality level. This percentage decreases with age, reaching a level that is 10% lower than the overall level for those aged 90 to 99 and then increases somewhat for those above 100. The overall decreasing ratios for these beneficiaries can be explained by the 'immigrant effect' which is discussed in the next section. Female mortality rates for this group converge to overall OAS rates.

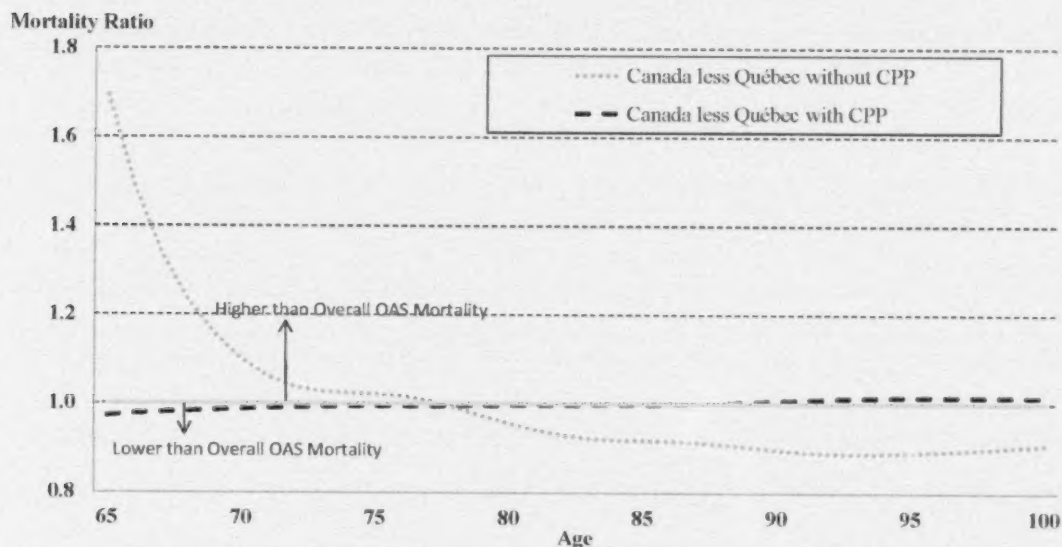
The ability to have been part of the labour force and to have contributed to the CPP is a significant predictor of mortality experience. Tables 59 to 62 in Appendix A show statistics for deaths, exposures, mortality rates and mortality ratios for the Canada less Québec subgroup by whether or not they are receiving CPP retirement pensions. Corresponding life tables by individual ages are provided in Tables 63 to 65 of the same appendix.

**Table 24 Mortality Rates by Receipt of a CPP Retirement Pension  
 (deaths per thousand, 2007)**

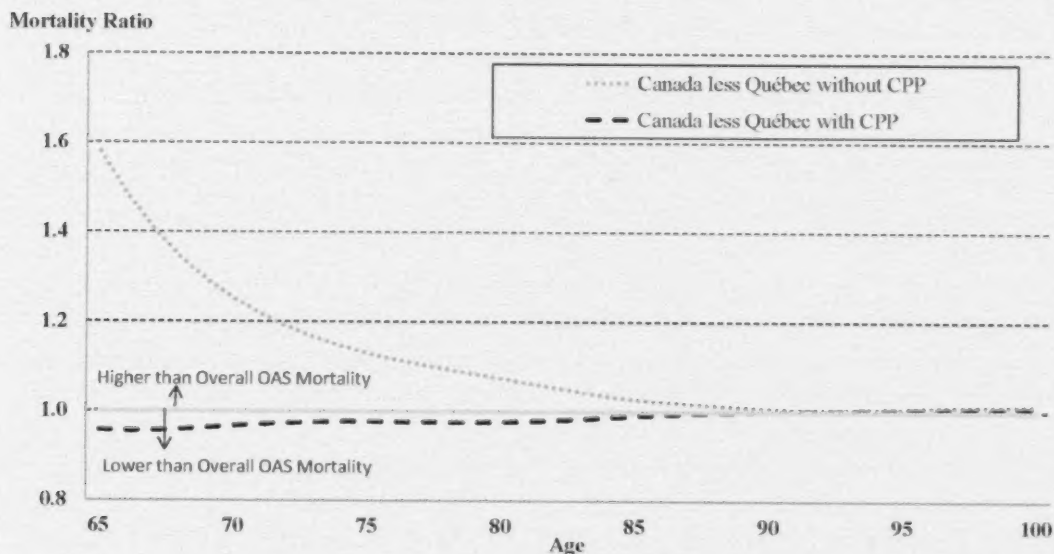
Age Group	(Canada less Québec)							
	Males				Females			
		Ratio with CPP to Overall OAS	without CPP	Ratio without CPP to Overall OAS		Ratio with CPP to Overall OAS	without CPP	Ratio without CPP to Overall OAS
	with CPP				with CPP			
65-69	16.6	0.98	23.3	1.37	10.0	0.96	14.9	1.42
70-74	26.8	0.99	28.7	1.06	16.5	0.97	20.6	1.20
75-79	44.2	0.99	45.0	1.01	27.6	0.97	31.8	1.12
80-84	74.2	1.00	70.2	0.94	48.3	0.98	52.7	1.07
85-89	123.5	1.00	114.0	0.92	86.8	0.99	90.4	1.03
90-94	199.3	1.01	178.2	0.90	151.3	0.99	154.1	1.01
95-99	290.8	1.01	258.4	0.90	237.6	1.00	241.3	1.01
100+	397.6	1.01	372.5	0.94	345.5	0.99	357.1	1.02

**Chart 15 Mortality Ratios by Receipt of a CPP Retirement Pension (2007)**

**Males**



**Females**





The mortality ratios for those OAS beneficiaries residing in Canada outside of Québec and not receiving a CPP retirement pension may be further analyzed by place of birth as shown in Table 25 and Chart 16. The lower mortality experience of immigrants can likely be linked to Canadian immigration screening policies, which include an assessment of medical conditions.

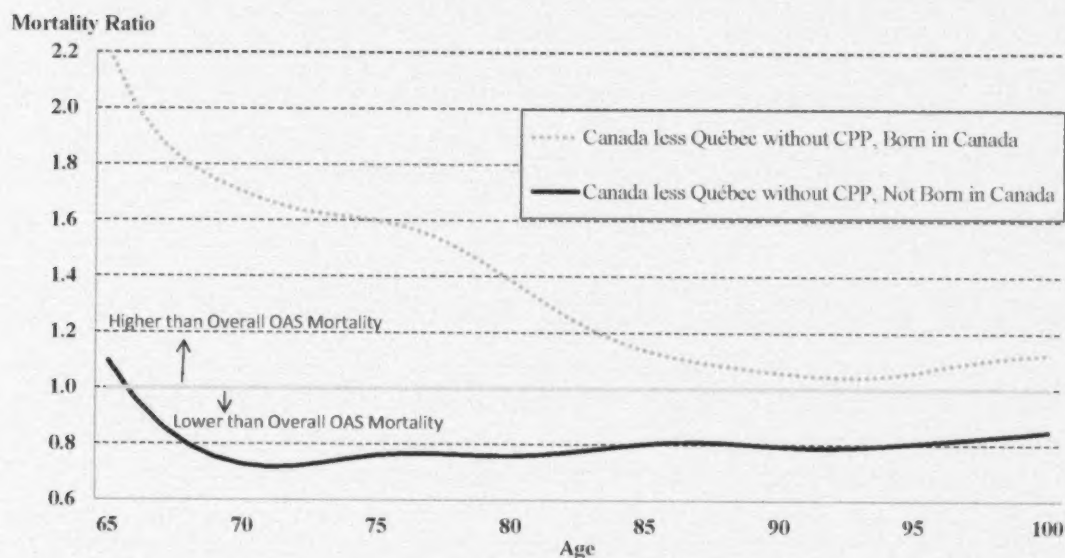
Those not born in Canada, or immigrants, experience much lower mortality compared to the overall OAS level for both sexes. As shown earlier in Table 12, a greater proportion of male OAS beneficiaries without CPP retirement pensions are immigrants compared to females, especially at the older ages. The greater proportion of male immigrants may explain the lower mortality ratios of male beneficiaries without CPP pensions compared to females. As shown in Table 25, the mortality ratios for male OAS beneficiaries without CPP pensions, who were born outside Canada remain below one for all ages, whereas the mortality level for the corresponding group of females shows convergence to the overall level.

**Table 25 Mortality Rates of Beneficiaries without CPP by Place of Birth  
 (deaths per thousand)**

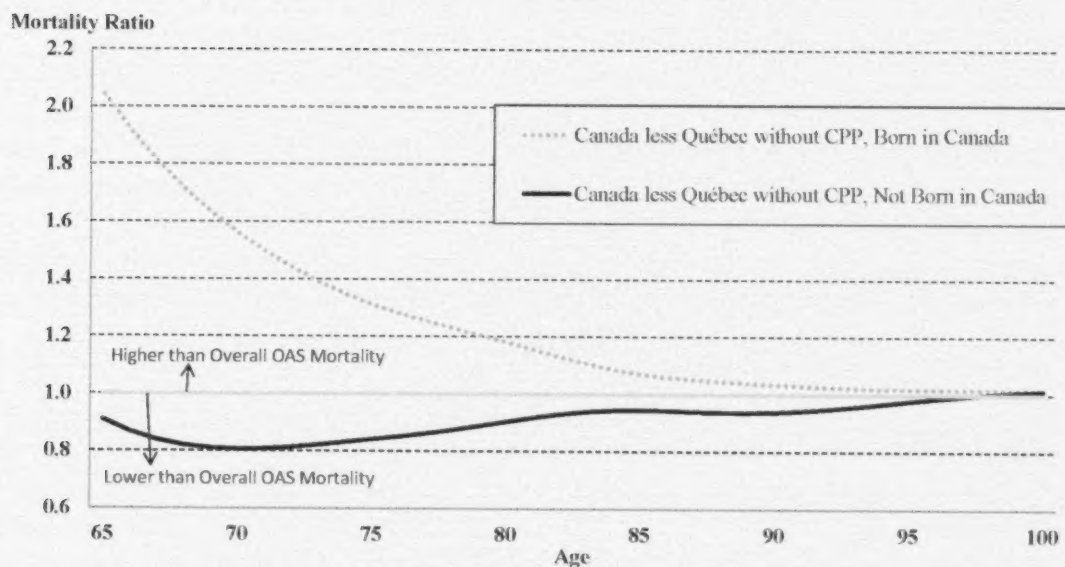
Age Group	(Canada less Québec, 2007)							
	Males				Females			
	without CPP Born in Canada	Ratio without CPP Born in Canada to Overall OAS	without CPP Born outside Canada	Ratio without CPP Born outside Canada to Overall OAS	without CPP Born in Canada	Ratio without CPP Born in Canada to Overall OAS	without CPP Born outside Canada	Ratio without CPP Born outside Canada to Overall OAS
65-69	32.0	1.89	15.0	0.89	19.1	1.82	8.9	0.85
70-74	44.8	1.66	20.2	0.75	24.8	1.45	14.1	0.83
75-79	68.7	1.54	34.4	0.77	36.0	1.27	25.0	0.88
80-84	95.3	1.28	58.2	0.78	56.6	1.14	46.4	0.94
85-89	137.9	1.12	100.4	0.81	94.1	1.07	82.8	0.94
90-94	208.9	1.06	158.7	0.80	157.0	1.03	147.3	0.97
95-99	307.7	1.07	237.2	0.83	239.3	1.00	241.8	1.02
100+	455.5	1.15	351.6	0.89	356.4	1.02	359.8	1.03

**Chart 16 Mortality Ratios of Beneficiaries without CPP by Place of Birth (2007)**

**Males**



**Females**



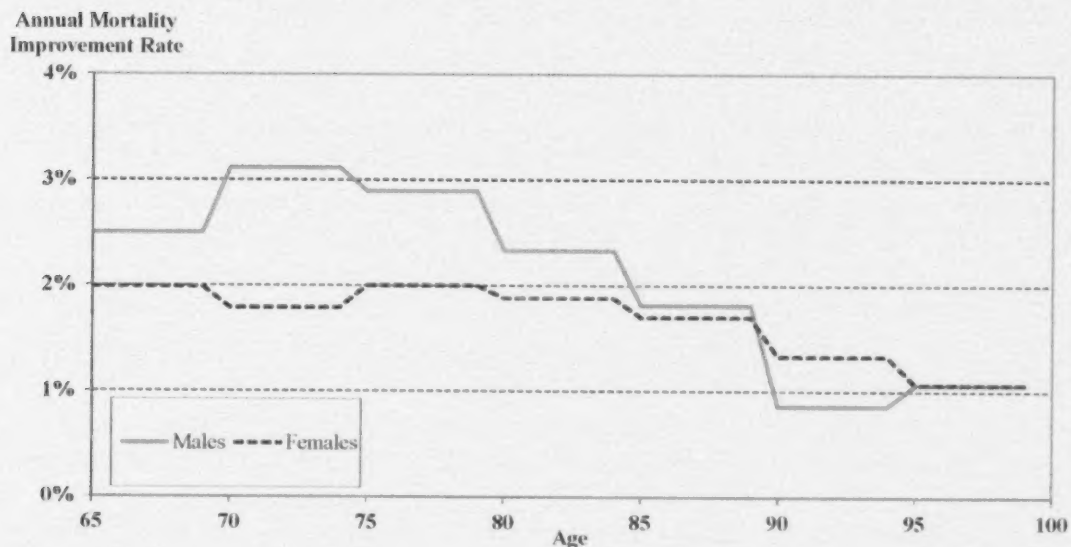
## V. Mortality Improvement Rates

Annual mortality improvement rates were determined over the period 2001 to 2009 inclusive. A longer experience period than five years that was used in the previous study was preferable in order to reduce statistical variation in the results. The five-year period 1999-2003 used for the previous study should be interpreted with caution. The same also applies for improvement rates at very advanced ages (95 and over) due to low exposures and the greater variation of results.

Four different methods were used to estimate the annual improvement rates. The same method that was used in the last OAS mortality experience study was chosen, and the resulting rates are shown in Chart 17. Except at the very advanced ages, male annual mortality improvement rates have been greater than female rates and exhibit a clearer declining pattern with age.

Further discussion about the different methods considered and resulting improvement rates are provided in Appendix C.

**Chart 17 OAS Beneficiary Annual Mortality Improvement Rates (2001-2009)**



Annual mortality improvement rates may be used to project mortality rates in the future. Table 26 shows the average annual mortality improvement rates of OAS Program beneficiaries by subgroup based on the period 2001 to 2009. In addition, annual mortality improvement rates for the general population (CHMD) are shown for the periods 2001 to 2009 and 1981 to 2001. As observed from the CHMD rates for both sexes, significant increases in mortality improvement rates at the older ages have recently occurred. Mortality rates for those aged 80 to 89 during the last decade decreased at a pace of about three times faster than that observed over the previous two decades. Overall, recent mortality improvement rates of OAS Program beneficiaries (2.7% for males and 1.9% for females) are close to those observed from the CHMD.

**Table 26 OAS Beneficiaries Annual Mortality Improvement Rates (2001-2009)**

Males								
Age Group	Overall OAS Program	CHMD <sup>1</sup>		Basic OAS without GIS	Basic OAS with GIS	Canada less Québec	Canada less Québec with CPP Retirement Pension	Canada less Québec without CPP Retirement Pension
		2001-2009	1981-2001					
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
65-69	2.5%	2.2%	2.2%	3.0%	1.2%	2.3%	2.3%	3.8%
70-74	3.1%	3.1%	1.9%	3.8%	2.4%	2.9%	2.8%	5.1%
75-79	2.9%	2.9%	1.5%	3.3%	2.5%	2.7%	2.6%	3.4%
80-84	2.3%	2.9%	1.0%	2.3%	2.4%	2.1%	2.1%	2.9%
85-89	1.8%	2.2%	0.3%	1.8%	1.7%	1.7%	1.6%	2.3%
90-94	0.9%	2.2%	-0.2%	0.7%	1.0%	0.8%	0.7%	2.1%
95-99	1.1%	2.7%	-0.5%	0.9%	1.1%	1.1%	1.1%	1.5%
100+	1.1%	1.5%	-0.6%	0.7%	0.8%	0.9%	1.1%	4.6%
65+	2.7%	2.6%	1.2%	3.1%	1.9%	2.4%	2.4%	3.5%
65-79	2.8%	2.8%	1.8%	3.4%	1.9%	2.6%	2.5%	4.1%
80-89	2.2%	2.6%	0.7%	2.2%	2.2%	2.0%	1.9%	2.6%
80+	2.0%	2.5%	0.5%	2.0%	2.0%	1.8%	1.8%	2.5%
90+	0.9%	2.3%	-0.3%	0.7%	1.0%	0.9%	0.8%	2.1%
Females								
Age Group	Overall OAS Program	CHMD <sup>1</sup>		Basic OAS without GIS	Basic OAS with GIS	Canada less Québec	Canada less Québec with CPP Retirement Pension	Canada less Québec without CPP Retirement Pension
		2001-2009	1981-2001					
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
65-69	2.0%	1.8%	1.5%	2.2%	1.4%	1.9%	1.7%	0.6%
70-74	1.8%	1.8%	1.4%	2.0%	1.7%	1.6%	1.5%	1.0%
75-79	2.0%	2.1%	1.2%	2.3%	1.8%	1.9%	1.7%	1.6%
80-84	1.9%	2.4%	1.0%	2.1%	1.5%	1.7%	1.8%	1.2%
85-89	1.7%	1.8%	0.4%	1.8%	1.5%	1.5%	1.6%	1.2%
90-94	1.3%	2.1%	0.1%	1.5%	1.2%	1.3%	1.2%	1.3%
95-99	1.1%	1.4%	-0.2%	1.7%	0.8%	0.7%	0.8%	0.7%
100+	0.5%	1.9%	-0.6%	0.9%	0.4%	0.4%	0.8%	0.3%
65+	1.9%	2.0%	0.8%	2.1%	1.5%	1.7%	1.6%	1.2%
65-79	1.9%	1.9%	1.3%	2.2%	1.6%	1.8%	1.6%	1.1%
80-89	1.8%	2.0%	0.7%	2.0%	1.5%	1.6%	1.7%	1.2%
80+	1.7%	2.0%	0.5%	1.9%	1.4%	1.5%	1.7%	1.2%
90+	1.3%	1.9%	0.0%	1.5%	1.1%	1.1%	1.1%	1.1%

Mortality improvement rates were calculated over the periods 2001-2009 and 1981-2001 for comparison purposes. From 1981 to 2007, the CHMD mortality rates were used. For 2008 and 2009, the mortality rates were estimated from Statistics Canada's "Deaths" publication (Catalogue no. 84F0211X).



In general, annual mortality improvement rates for males have been greater than for females, and as a result, the gap in mortality rates between the two sexes has been narrowing over time.

While mortality improvement rates tend to diminish with age, this pattern is more apparent for males than females. Both sexes have experienced greater improvement rates for those between the ages of 65 and 79 compared to those aged 80 and older. Annual mortality improvement rates for OAS Program beneficiaries aged 65 to 79 are 2.8% for males and 1.9% for females (the same as for the CHMD), while the rates are 2.0% for males and 1.7% for females for those 80 and older (less than the CHMD rates). At very advanced ages, despite low levels of exposures, annual mortality improvement is observed for both sexes.

The analysis by type of OAS benefit reveals higher mortality improvement rates for those with a higher level of income. Males aged 65 or older who received an OAS pension without the GIS experienced an annual improvement rate of 3.1% (2.1% for females) compared to 1.9% (1.5% for females) for those who received both the OAS pension and income-tested GIS benefit.

The mortality improvement rates for OAS beneficiaries in Canada outside of Québec are generally slightly less than the overall rates for the OAS Program. For those aged 65 to 79, the rates are 2.6% for males and 1.8% for females, while the rates are 1.8% for males and 1.5% females for those 80 and older.

For male OAS beneficiaries residing in Canada outside of Québec, those without CPP pensions have experienced higher mortality improvement rates compared to those with CPP pensions (4.1% compared to 2.5% for those aged 65 to 79). In contrast, for female OAS beneficiaries residing in Canada outside of Québec, those without CPP pensions have experienced lower mortality improvement rates compared to those with CPP pensions (1.1% compared to 1.6% for those aged 65 to 79).

## VI. Life Expectancies

### A. Comparison of Life Expectancies at 65 by Marital Status and Type of Benefit

Table 27 shows a comparison of life expectancies of OAS Program beneficiaries by socioeconomic level by comparing life expectancy differentials for both sexes by marital status and type of OAS benefit received.

The differentials in life expectancies at age 65 show that in 2007 males experience a wider range than females between the wealthier and poorer OAS beneficiaries. The differentials in life expectancies in 2007 between those who receive OAS pensions without the GIS and those who receive both OAS pensions and GIS benefits are 2.4 years for males and 2.1 years for females.

Males also show higher differentials in life expectancy at age 65 by marital status compared to females. For example, in 2007, married males on an overall basis live on average 18.8 years at age 65 or 3.3 years more than single males. In comparison, married females live on average 21.9 years or 1.7 years more than single females.

**Table 27 Life Expectancies at Age 65 by Marital Status and Type of Benefit (years)**

Type of Benefit	2007							
	Males				Females			
	Overall	Single	Married	Differential by Marital Status	Overall	Single	Married	Differential by Marital Status
OAS Program	17.8	15.5	18.8	3.3	21.0	20.2	21.9	1.7
With GIS	16.2	14.1	17.6	3.5	19.8	19.4	20.7	1.3
Without GIS	18.6	16.7	19.3	2.6	21.9	21.1	22.5	1.4
Differential by Type of Benefit	2.4	2.6	1.7	-	2.1	1.7	1.8	-
Type of Benefit	2001*							
	Males				Females			
	Overall	Single	Married	Differential by Marital Status	Overall	Single	Married	Differential by Marital Status
OAS Program	16.6	14.2	17.9	3.7	20.2	19.7	21.0	1.3
GIS	15.0	13.0	16.3	3.3	19.0	18.6	19.8	1.2
No GIS	17.4	15.1	18.6	3.5	21.1	20.9	21.5	0.6
Differential by Type of Benefit	2.4	2.1	2.3	-	2.1	2.3	1.7	-

\* Data for 2001 taken from OAS Program Mortality Experience: Actuarial Study No. 5.

Married males without GIS benefits are expected to live 2.6 years more than their single counterparts. In comparison, married females without GIS benefits are expected to live 1.4 years more than single females. Married males without GIS benefits are also expected to live 1.7 years more than married males who receive GIS benefits, while the corresponding differential for females is 1.8 years. For single males, those without GIS benefits have a life expectancy at 65 that is 2.6 years higher than those receiving the GIS, compared to a differential of 1.7 years for single females.

## B. Comparison of Life Expectancies at age 65 by Place of Birth and Receipt of CPP Retirement Pension

A comparison of life expectancies at age 65 without any assumed future mortality improvements between the various OAS Program subgroups and the CHMD population is shown in Table 28.

Overall, since the mortality level of OAS beneficiaries is higher than that of the CHMD, life expectancies at age 65 are correspondingly lower. In 2007, the differential in life expectancies at age 65 between the overall OAS Program and the CHMD is slightly larger for males (0.4 year) than for females (0.3 year). As a comparison, in 2001, the differential in life expectancies at age 65 between the overall OAS Program and the benchmark mortality table was 0.5 year for males and 0.4 year for females.

**Table 28 Life Expectancies at Age 65 by Place of Birth and Receipt of CPP Pension**

	2007		
	Males	Females	Female – Male Differential
OAS Program	17.8	21.0	3.2
Benchmark (CHMD 2007)	18.2	21.3	3.1
Differential between CHMD & OAS Program	0.4	0.3	-
Born in Canada	17.3	20.6	3.3
Born outside of Canada (immigrants)	19.1	22.1	3.0
Differential between immigrants and born in Canada	1.8	1.5	-
Canada less Québec	17.9	21.0	3.1
Canada less Québec without CPP retirement pension	17.5	20.1	2.6
Canada less Québec with CPP retirement pension	17.9	21.1	3.2
Differential between Canada less Québec with and without CPP retirement pension	0.4	1.0	-
	2001*		
	Males	Females	Female – Male Differential
OAS Program	16.6	20.2	3.6
Benchmark (1995-1997 Canada Life Table projected to 2001)	17.1	20.6	3.5
Differential between Benchmark & OAS Program	0.5	0.4	
Born in Canada	16.2	19.9	3.7
Born outside of Canada (immigrants)	17.8	21.1	3.3
Differential between immigrants and born in Canada	1.6	1.2	
Canada less Québec	16.8	20.2	3.4
Canada less Québec without CPP retirement pension	15.4	19.5	4.1
Canada less Québec with CPP retirement pension	16.8	20.5	3.7
Differential between Canada less Québec with and without CPP retirement pension	1.4	1.0	

\* Data for 2001 taken from OAS Program Mortality Experience: Actuarial Study No. 5.

In 2007, those OAS beneficiaries who were born outside of Canada have greater life expectancies than those born in Canada. The differential is 1.8 years for males and 1.5 years for females. For those born in Canada, the gap between female and male life expectancies is 3.3 years, which is higher than the corresponding differential of 3.0 years for immigrants.

For the Canada less Québec population, the differential in life expectancy at 65 between females and males has narrowed from 3.4 years in 2001 to 3.1 years in 2007. As discussed in section V regarding mortality improvement rates, this is consistent with the fact that over the period from 2001 to 2007, male mortality improvement rates have been greater than those experienced by females.

For males in 2007, the differential in life expectancies at age 65 between residents in Canada outside of Québec who receive CPP retirement pensions and those who do not receive CPP pensions is 0.4 year, while the corresponding differential in 2001 was 1.4 years. For females, the corresponding differential of 1.0 year did not vary from 2001 to 2007.

### C. Probability of surviving from age 65

The probability of surviving from age 65 to a given age by type of benefit received is displayed by the survival curves for males and females in Table 29 and Chart 18. For each sex, the probability of survival increases as income increases, corresponding with the type of benefit received. For example, the probability of a 65 year old male surviving to age 85 (given by  ${}_{20}P_{65}$ ) increases from 35% for a GIS recipient to 46% for a non-GIS recipient, and the corresponding probabilities for females are 53% and 62%.

**Table 29 Survival Probabilities at Age 65 (2007)\***

<b>Males</b>	<b><math>{}_5P_{65}</math></b>	<b><math>{}_{10}P_{65}</math></b>	<b><math>{}_{15}P_{65}</math></b>	<b><math>{}_{20}P_{65}</math></b>	<b><math>{}_{25}P_{65}</math></b>	<b><math>{}_{30}P_{65}</math></b>	<b><math>{}_{35}P_{65}</math></b>
With GIS	88%	73%	55%	35%	17%	5%	1%
Without GIS	93%	83%	67%	46%	24%	8%	1%
Overall	92%	80%	63%	43%	21%	7%	1%
<b>Females</b>	<b><math>{}_5P_{65}</math></b>	<b><math>{}_{10}P_{65}</math></b>	<b><math>{}_{15}P_{65}</math></b>	<b><math>{}_{20}P_{65}</math></b>	<b><math>{}_{25}P_{65}</math></b>	<b><math>{}_{30}P_{65}</math></b>	<b><math>{}_{35}P_{65}</math></b>
With GIS	93%	83%	70%	53%	32%	13%	3%
Without GIS	96%	89%	79%	62%	40%	17%	4%
Overall	95%	87%	75%	58%	36%	15%	4%

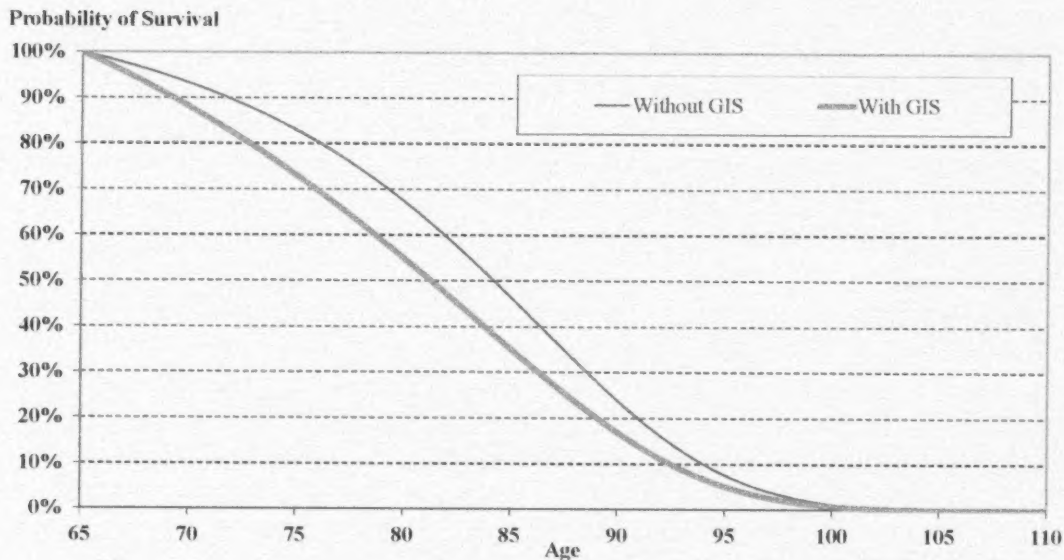
\* The symbol  ${}_nP_{65}$  is the probability that a person age 65 will be alive n years later.



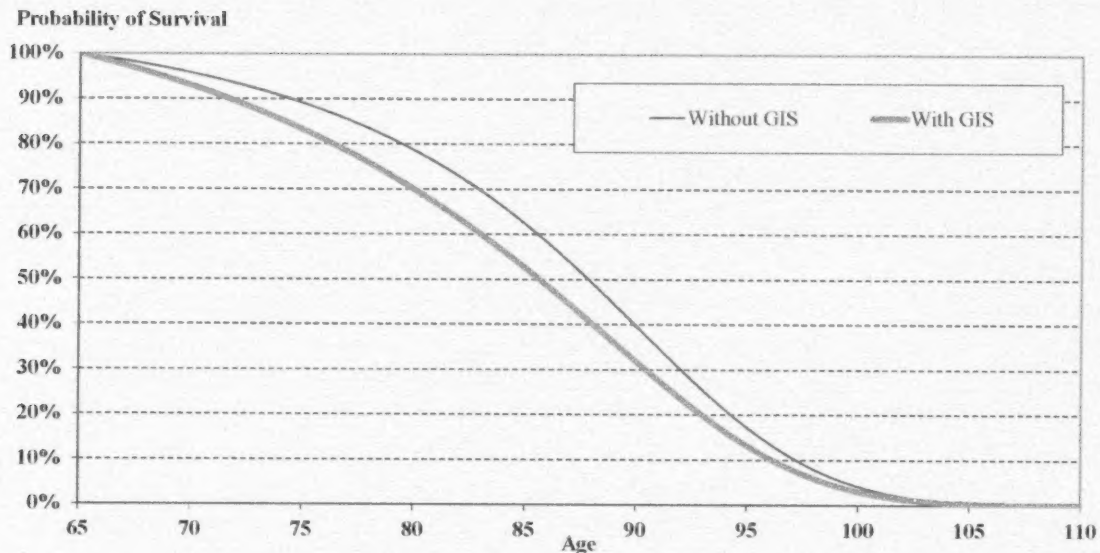
The survival curves for each sex do not reflect much squaring at advanced ages as the mortality rates follow a more gradual growth with age rather than an exponential growth. More of an expansion of the survival curves is seen for females than males, since females mortality rates are more level at the advanced ages.

**Chart 18 OAS Beneficiary Survival Curves at Age 65 by Type of Benefit (2007)**

**Males**



**Females**



## VII. Conclusion

The availability and quality of the administrative OAS beneficiaries' database provide sufficient and reliable data upon which this study is based and allow for a more accurate measurement of the level and trend in mortality experienced by the oldest portion of the Canadian population.

The aging of the Canadian population has increased substantially since the inception of the OAS Program in 1952. Over the last decade, life expectancy at age 65 of the general population has experienced the largest ever increase since the Program's inception, with life expectancy at age 65 increasing by about two years to reach 20 years in 2010.

This study also shows that while the growth in the Canadian population is slowing down, the segment of the population aged 80 and older has been one of the fastest growing age groups, and this trend is expected to continue. Mortality rates between the ages of 80 and 90 have recently decreased at a pace of about three times faster than that observed over the previous two decades.

In general, GIS recipients experience higher mortality and thus lower life expectancies relative to the overall OAS Program population. In comparison, those who do not receive GIS benefits experience lower mortality and higher life expectancies. In 2007, male OAS pensioners without GIS benefits had a life expectancy at age 65 of 18.6 years, which was 0.8 year higher than the overall level for male OAS beneficiaries and 2.4 years higher than male GIS recipients. Female pensioners without GIS benefits had a life expectancy of 21.9 years, or 0.9 year higher than the overall female level and 2.1 years higher than female GIS recipients. These observations may be explained by the relationship between high levels of income and improved health and quality of life.

## VIII. Appendices

### A. Supplementary Tables

**Table 30 Deaths and Exposures (2005-2009)**

Age	Deaths		Exposures	
	Males	Females	Males	Females
65	8,900	5,759	634,433	669,341
66	9,749	6,428	632,114	669,340
67	10,215	6,640	598,412	638,221
68	10,831	7,147	568,172	611,714
69	11,128	7,444	543,053	589,504
70	11,823	8,008	521,112	571,280
71	12,151	8,610	499,603	553,702
72	13,117	9,302	481,653	540,191
73	14,099	10,029	467,077	531,021
74	15,168	10,947	450,620	521,475
75	16,047	11,785	433,079	510,965
76	16,822	12,761	412,170	498,624
77	17,760	13,990	388,752	483,957
78	18,371	14,840	361,610	465,958
79	18,783	16,039	333,500	446,802
80	19,134	17,146	305,023	427,279
81	19,271	18,253	277,537	407,872
82	19,535	19,765	249,466	385,474
83	19,612	20,561	223,130	363,151
84	19,148	21,842	196,362	336,476
85	18,489	22,497	170,247	307,374
86	17,206	22,201	142,242	271,222
87	15,974	22,357	117,213	235,777
88	14,194	21,293	94,326	201,286
89	12,565	20,571	74,992	170,317
90	11,105	19,296	59,180	142,700
91	9,978	18,565	47,117	120,946
92	8,357	17,054	36,507	99,900
93	7,029	15,280	27,368	80,492
94	5,535	13,242	19,833	63,035
95	4,143	11,310	13,877	47,459
96	3,090	9,002	9,401	34,782
97	2,207	7,141	6,203	24,888
98	1,541	5,599	3,987	17,173
99	1,073	3,907	2,501	11,514
100	699	2,878	1,471	7,543
101	410	2,012	850	4,717
102	238	1,285	495	2,857
103	139	826	281	1,701
104	87	508	152	1,001
105	54	304	80	556
106	28	164	32	295
107	8	91	14	170
108	9	58	7	88
109	3	24	2	45
110+	1	25	6	41
<b>Total</b>	<b>435,813</b>	<b>484,772</b>	<b>9,405,260</b>	<b>12,070,224</b>

**Table 31 Beneficiaries (2005-2009)**

As at 31 <sup>st</sup> December	2005		2006		2007		2008		2009	
Age	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
65	114,096	120,663	117,460	123,796	126,488	132,158	132,992	139,267	134,140	141,099
66	118,095	125,472	124,777	131,968	128,640	135,420	138,442	144,572	144,466	151,421
67	116,236	123,008	117,091	124,895	123,747	131,443	127,579	134,717	137,103	143,788
68	108,868	116,996	114,896	122,409	115,809	124,097	122,350	130,525	125,925	133,771
69	106,846	115,084	107,341	116,140	113,336	121,434	114,253	123,093	120,547	129,455
70	103,218	112,968	105,139	113,969	105,767	115,140	111,434	120,284	112,365	121,978
71	99,684	110,290	101,215	111,821	103,123	112,748	103,766	113,909	109,377	118,933
72	96,800	107,145	97,531	108,925	99,122	110,459	100,986	111,330	101,680	112,559
73	96,612	109,379	94,440	105,724	95,288	107,506	96,833	108,929	98,562	109,730
74	92,888	107,202	93,919	107,615	92,012	104,088	92,734	105,779	94,365	107,258
75	90,647	106,119	90,075	105,148	91,240	105,761	89,326	102,250	89,994	103,925
76	81,957	99,929	87,456	103,977	87,054	103,038	88,174	103,661	86,409	100,237
77	78,440	98,091	78,791	97,552	84,279	101,697	83,885	100,773	85,084	101,334
78	72,808	94,456	75,085	95,469	75,551	94,983	80,795	99,122	80,557	98,292
79	67,089	91,223	69,329	91,703	71,608	92,757	72,054	92,325	77,239	96,360
80	62,482	88,829	63,487	88,218	65,730	88,740	67,943	89,853	68,533	89,370
81	56,581	84,672	58,826	85,543	59,896	85,017	61,918	85,640	64,135	86,632
82	50,834	79,345	52,898	81,105	55,025	82,136	56,190	81,621	58,051	82,225
83	46,241	75,499	47,023	75,559	49,121	77,380	51,213	78,272	52,275	77,924
84	41,602	70,490	42,397	71,472	43,331	71,606	45,230	73,434	47,166	74,304
85	36,143	64,413	37,848	66,202	38,696	67,334	39,523	67,457	41,350	69,166
86	27,374	51,828	32,451	60,080	34,208	61,835	34,911	62,853	35,684	63,159
87	23,127	46,013	24,187	47,908	28,938	55,777	30,553	57,107	31,207	58,187
88	19,280	40,015	20,181	42,044	21,235	43,909	25,519	51,027	26,957	52,295
89	16,326	35,969	16,651	36,034	17,510	38,076	18,378	39,676	22,116	46,187
90	13,702	31,603	13,863	31,909	14,235	32,237	14,897	34,082	15,672	35,482
91	11,178	27,745	11,413	27,587	11,608	28,063	11,959	28,398	12,467	30,093
92	8,674	22,495	9,169	23,946	9,306	24,007	9,532	24,249	9,802	24,582
93	6,462	18,185	6,959	19,043	7,367	20,398	7,497	20,382	7,621	20,690
94	4,517	13,819	5,044	15,093	5,456	15,928	5,770	16,952	5,861	17,100
95	3,397	11,052	3,451	11,323	3,863	12,343	4,228	12,968	4,371	13,857
96	2,352	8,051	2,488	8,744	2,532	9,014	2,889	9,883	3,174	10,354
97	1,611	6,048	1,698	6,198	1,808	6,788	1,852	7,094	2,095	7,754
98	1,089	4,244	1,129	4,601	1,213	4,734	1,274	5,196	1,348	5,423
99	669	2,962	735	3,091	793	3,369	822	3,497	862	3,801
100+	975	5,359	1,056	5,567	1,151	5,872	1,218	6,261	1,314	6,723
<b>Total</b>	<b>1,878,900</b>	<b>2,426,661</b>	<b>1,927,499</b>	<b>2,472,378</b>	<b>1,986,086</b>	<b>2,527,292</b>	<b>2,048,919</b>	<b>2,586,438</b>	<b>2,109,874</b>	<b>2,645,448</b>



**Table 32 Life Table of OAS Beneficiaries (2007)**

Age	Males				Females			
	$l_x$	$q_x$	$d_x$	${}^o e_x$	$l_x$	$q_x$	$d_x$	${}^o e_x$
65	100,000	0.0140	1,402	17.83	100,000	0.0086	864	21.00
66	98,598	0.0154	1,520	17.08	99,136	0.0095	941	20.18
67	97,078	0.0169	1,644	16.33	98,195	0.0104	1,025	19.37
68	95,434	0.0186	1,772	15.61	97,170	0.0115	1,117	18.56
69	93,662	0.0203	1,905	14.89	96,053	0.0127	1,217	17.77
70	91,757	0.0223	2,046	14.19	94,836	0.0140	1,324	17.00
71	89,711	0.0245	2,196	13.50	93,512	0.0154	1,439	16.23
72	87,515	0.0269	2,358	12.83	92,073	0.0170	1,563	15.48
73	85,157	0.0297	2,531	12.17	90,510	0.0187	1,696	14.73
74	82,626	0.0328	2,713	11.53	88,814	0.0207	1,839	14.01
75	79,913	0.0363	2,903	10.90	86,975	0.0229	1,993	13.29
76	77,010	0.0402	3,098	10.30	84,982	0.0254	2,160	12.59
77	73,912	0.0446	3,294	9.71	82,822	0.0282	2,340	11.91
78	70,618	0.0494	3,490	9.14	80,482	0.0315	2,532	11.24
79	67,128	0.0548	3,681	8.59	77,950	0.0351	2,737	10.59
80	63,447	0.0609	3,863	8.05	75,213	0.0393	2,953	9.95
81	59,584	0.0677	4,032	7.54	72,260	0.0440	3,180	9.34
82	55,552	0.0752	4,180	7.06	69,080	0.0494	3,414	8.75
83	51,372	0.0837	4,300	6.59	65,666	0.0556	3,652	8.18
84	47,072	0.0931	4,383	6.14	62,014	0.0627	3,887	7.63
85	42,689	0.1035	4,419	5.72	58,127	0.0707	4,110	7.11
86	38,270	0.1150	4,402	5.33	54,017	0.0798	4,309	6.61
87	33,868	0.1276	4,322	4.96	49,708	0.0899	4,470	6.14
88	29,546	0.1413	4,175	4.61	45,238	0.1012	4,577	5.70
89	25,371	0.1561	3,960	4.28	40,661	0.1136	4,618	5.28
90	21,411	0.1718	3,679	3.98	36,043	0.1271	4,581	4.89
91	17,732	0.1885	3,343	3.71	31,462	0.1417	4,459	4.53
92	14,389	0.2060	2,963	3.45	27,003	0.1575	4,252	4.20
93	11,426	0.2241	2,560	3.21	22,751	0.1743	3,965	3.89
94	8,866	0.2428	2,153	3.00	18,786	0.1921	3,609	3.60
95	6,713	0.2621	1,759	2.80	15,177	0.2109	3,201	3.34
96	4,954	0.2818	1,396	2.62	11,976	0.2305	2,761	3.10
97	3,558	0.3022	1,075	2.45	9,215	0.2511	2,313	2.88
98	2,483	0.3233	803	2.29	6,902	0.2723	1,880	2.68
99	1,680	0.3449	579	2.15	5,022	0.2943	1,478	2.49
100	1,101	0.3671	404	2.01	3,544	0.3169	1,123	2.32
101	697	0.3896	272	1.89	2,421	0.3399	823	2.17
102	425	0.4124	175	1.78	1,598	0.3631	580	2.03
103	250	0.4353	109	1.67	1,018	0.3866	394	1.90
104	141	0.4583	65	1.58	624	0.4100	256	1.79
105	76	0.4811	37	1.49	368	0.4333	159	1.69
106	39	0.5036	20	1.42	209	0.4563	95	1.59
107	19	0.5258	10	1.34	114	0.4787	55	1.51
108	9	0.5473	5	1.28	59	0.5004	30	1.43
109	4	0.5680	2	1.22	29	0.5212	15	1.36
110	2	0.5878	1	1.17	14	0.5410	8	1.30
111	1	0.6065	1	1.12	6	0.5596	3	1.25
112	0	0.6239	0	1.08	3	0.5768	2	1.20
113	0	0.6399	0	1.05	1	0.5924	1	1.16
114	0	0.6543	0	1.01	0	0.6064	0	1.13
115	0	0.6669	0	0.99	0	0.6187	0	1.10
120	0	0.7000	0	0.80	0	0.6500	0	0.85

**Table 33 Deaths by Place of Birth (2005-2009)**

Age	Born in Canada		Born outside Canada		OAS Program	
	Males	Females	Males	Females	Males	Females
65	7,104	4,669	1,796	1,090	8,900	5,759
66	7,639	5,147	2,110	1,281	9,749	6,428
67	8,046	5,365	2,169	1,276	10,215	6,640
68	8,508	5,711	2,323	1,436	10,831	7,147
69	8,578	5,984	2,550	1,460	11,128	7,444
70	9,012	6,343	2,811	1,665	11,823	8,008
71	9,279	6,803	2,872	1,807	12,151	8,610
72	9,873	7,383	3,244	1,919	13,117	9,302
73	10,666	7,875	3,433	2,154	14,099	10,029
74	11,456	8,567	3,712	2,381	15,168	10,947
75	12,039	9,199	4,008	2,587	16,047	11,785
76	12,561	9,922	4,262	2,839	16,822	12,761
77	13,153	10,754	4,607	3,237	17,760	13,990
78	13,441	11,206	4,930	3,634	18,371	14,840
79	13,598	12,081	5,186	3,958	18,783	16,039
80	13,923	12,693	5,212	4,453	19,134	17,146
81	13,970	13,271	5,301	4,982	19,271	18,253
82	13,967	14,433	5,568	5,332	19,535	19,765
83	14,015	15,058	5,597	5,504	19,612	20,561
84	13,692	15,953	5,456	5,889	19,148	21,842
85	13,292	16,558	5,197	5,939	18,489	22,497
86	12,508	16,643	4,699	5,558	17,206	22,201
87	11,802	17,108	4,172	5,249	15,974	22,357
88	10,641	16,472	3,553	4,822	14,194	21,293
89	9,456	16,147	3,110	4,424	12,565	20,571
90	8,450	15,182	2,655	4,114	11,105	19,296
91	7,467	14,529	2,511	4,036	9,978	18,565
92	6,178	13,156	2,179	3,898	8,357	17,054
93	5,047	11,491	1,982	3,789	7,029	15,280
94	3,808	9,638	1,728	3,605	5,535	13,242
95	2,594	7,814	1,550	3,496	4,143	11,310
96	1,782	5,542	1,308	3,460	3,090	9,002
97	1,155	3,966	1,052	3,176	2,207	7,141
98	709	2,692	832	2,907	1,541	5,599
99	446	1,620	627	2,287	1,073	3,907
100	234	1,141	465	1,737	699	2,878
101	159	723	251	1,289	410	2,012
102	85	461	153	824	238	1,285
103	42	290	98	537	139	826
104	28	176	59	332	87	508
105	11	115	43	189	54	304
106	9	66	19	98	28	164
107	4	28	5	63	8	91
108	2	23	7	35	9	58
109	1	11	2	13	3	24
110+	0	8	1	17	1	25
<b>Total</b>	<b>320,420</b>	<b>360,006</b>	<b>115,393</b>	<b>124,766</b>	<b>435,813</b>	<b>484,772</b>

**Table 34 Exposures by Place of Birth (2005-2009)**

Age	Born in Canada		Born outside Canada		OAS Program	
	Males	Females	Males	Females	Males	Females
65	459,025	488,106	175,408	181,235	634,433	669,341
66	454,392	485,714	177,721	183,626	632,114	669,340
67	427,882	461,130	170,530	177,091	598,412	638,221
68	403,532	439,513	164,641	172,200	568,172	611,714
69	381,687	420,743	161,366	168,761	543,053	589,504
70	364,190	407,430	156,922	163,850	521,112	571,280
71	347,369	394,782	152,234	158,920	499,603	553,702
72	334,787	386,672	146,866	153,519	481,653	540,191
73	325,291	382,728	141,786	148,293	467,077	531,021
74	313,820	377,464	136,800	144,011	450,620	521,475
75	301,370	370,982	131,709	139,983	433,079	510,965
76	286,449	362,277	125,721	136,348	412,170	498,624
77	269,072	350,245	119,680	133,712	388,752	483,957
78	248,755	334,066	112,855	131,892	361,610	465,958
79	228,297	317,186	105,203	129,616	333,500	446,802
80	208,446	300,981	96,577	126,297	305,023	427,279
81	189,254	285,574	88,283	122,298	277,537	407,872
82	169,697	269,804	79,769	115,670	249,466	385,474
83	152,312	256,115	70,818	107,036	223,130	363,151
84	134,659	239,651	61,703	96,825	196,362	336,476
85	117,045	221,089	53,202	86,285	170,247	307,374
86	99,038	198,758	43,204	72,464	142,242	271,222
87	83,312	176,222	33,901	59,555	117,213	235,777
88	67,911	152,756	26,415	48,529	94,326	201,286
89	54,615	131,025	20,377	39,292	74,992	170,317
90	43,477	110,782	15,703	31,918	59,180	142,700
91	34,326	93,406	12,791	27,540	47,117	120,946
92	26,036	75,954	10,471	23,947	36,507	99,900
93	19,028	59,900	8,340	20,592	27,368	80,492
94	13,197	45,522	6,636	17,512	19,833	63,035
95	8,599	32,194	5,278	15,265	13,877	47,459
96	5,315	21,427	4,086	13,355	9,401	34,782
97	3,118	13,752	3,086	11,137	6,203	24,888
98	1,729	8,318	2,257	8,855	3,987	17,173
99	931	4,937	1,570	6,577	2,501	11,514
100	513	2,940	957	4,603	1,471	7,543
101	293	1,739	557	2,978	850	4,717
102	159	1,031	336	1,826	495	2,857
103	90	623	191	1,078	281	1,701
104	43	384	109	617	152	1,001
105	21	210	59	346	80	556
106	11	111	21	184	32	295
107	4	64	10	105	14	170
108	1	33	6	55	7	88
109	1	13	2	31	2	45
110+	0	5	6	35	6	41
<b>Total</b>	<b>6,579,098</b>	<b>8,684,359</b>	<b>2,826,162</b>	<b>3,385,865</b>	<b>9,405,260</b>	<b>12,070,224</b>

**Table 35 Mortality Rates by Place of Birth (2007)**

Age	Born in Canada		Born outside Canada		OAS Program	
	Males	Females	Males	Females	Males	Females
65	0.0154	0.0095	0.0104	0.0062	0.0140	0.0086
66	0.0169	0.0105	0.0115	0.0067	0.0154	0.0095
67	0.0186	0.0117	0.0127	0.0073	0.0169	0.0104
68	0.0204	0.0129	0.0141	0.0081	0.0186	0.0115
69	0.0223	0.0141	0.0157	0.0089	0.0203	0.0127
70	0.0244	0.0155	0.0174	0.0100	0.0223	0.0140
71	0.0267	0.0170	0.0193	0.0112	0.0245	0.0154
72	0.0293	0.0187	0.0215	0.0127	0.0269	0.0170
73	0.0322	0.0204	0.0240	0.0143	0.0297	0.0187
74	0.0355	0.0224	0.0268	0.0162	0.0328	0.0207
75	0.0391	0.0246	0.0300	0.0184	0.0363	0.0229
76	0.0431	0.0272	0.0336	0.0208	0.0402	0.0254
77	0.0476	0.0300	0.0377	0.0236	0.0446	0.0282
78	0.0526	0.0333	0.0423	0.0268	0.0494	0.0315
79	0.0582	0.0370	0.0475	0.0305	0.0548	0.0351
80	0.0644	0.0411	0.0533	0.0347	0.0609	0.0393
81	0.0713	0.0459	0.0598	0.0395	0.0677	0.0440
82	0.0791	0.0513	0.0671	0.0450	0.0752	0.0494
83	0.0877	0.0574	0.0751	0.0512	0.0837	0.0556
84	0.0972	0.0644	0.0839	0.0582	0.0931	0.0627
85	0.1078	0.0724	0.0937	0.0660	0.1035	0.0707
86	0.1194	0.0815	0.1043	0.0747	0.1150	0.0798
87	0.1322	0.0917	0.1161	0.0845	0.1276	0.0899
88	0.1461	0.1030	0.1289	0.0954	0.1413	0.1012
89	0.1610	0.1155	0.1430	0.1074	0.1561	0.1136
90	0.1769	0.1291	0.1581	0.1207	0.1718	0.1271
91	0.1938	0.1438	0.1744	0.1353	0.1885	0.1417
92	0.2116	0.1595	0.1917	0.1512	0.2060	0.1575
93	0.2301	0.1763	0.2100	0.1684	0.2241	0.1743
94	0.2493	0.1939	0.2290	0.1869	0.2428	0.1921
95	0.2692	0.2124	0.2487	0.2066	0.2621	0.2109
96	0.2897	0.2317	0.2689	0.2273	0.2818	0.2305
97	0.3109	0.2517	0.2900	0.2490	0.3022	0.2511
98	0.3327	0.2726	0.3117	0.2714	0.3233	0.2723
99	0.3549	0.2941	0.3341	0.2946	0.3449	0.2943
100	0.3776	0.3163	0.3570	0.3182	0.3671	0.3169
101	0.4004	0.3389	0.3803	0.3422	0.3896	0.3399
102	0.4234	0.3618	0.4039	0.3665	0.4124	0.3631
103	0.4465	0.3849	0.4277	0.3908	0.4353	0.3866
104	0.4693	0.4081	0.4515	0.4149	0.4583	0.4100
105	0.4919	0.4312	0.4751	0.4387	0.4811	0.4333
106	0.5141	0.4540	0.4985	0.4620	0.5036	0.4563
107	0.5357	0.4763	0.5213	0.4847	0.5258	0.4787
108	0.5566	0.4980	0.5436	0.5064	0.5473	0.5004
109	0.5766	0.5189	0.5650	0.5271	0.5680	0.5212
110	0.5955	0.5389	0.5854	0.5466	0.5878	0.5410
120	0.7000	0.6500	0.7000	0.6500	0.7000	0.6500



**Table 36 Mortality Ratios by Place of Birth (2007)\***

Age	Born in Canada		Born outside Canada	
	Males	Females	Males	Females
65	1.10	1.10	0.74	0.72
66	1.10	1.11	0.75	0.70
67	1.10	1.12	0.75	0.70
68	1.10	1.12	0.76	0.70
69	1.10	1.12	0.77	0.71
70	1.09	1.11	0.78	0.72
71	1.09	1.11	0.79	0.73
72	1.09	1.10	0.80	0.75
73	1.08	1.09	0.81	0.76
74	1.08	1.08	0.82	0.78
75	1.08	1.08	0.83	0.80
76	1.07	1.07	0.84	0.82
77	1.07	1.06	0.85	0.84
78	1.06	1.06	0.86	0.85
79	1.06	1.05	0.87	0.87
80	1.06	1.05	0.88	0.88
81	1.05	1.04	0.88	0.90
82	1.05	1.04	0.89	0.91
83	1.05	1.03	0.90	0.92
84	1.04	1.03	0.90	0.93
85	1.04	1.02	0.90	0.93
86	1.04	1.02	0.91	0.94
87	1.04	1.02	0.91	0.94
88	1.03	1.02	0.91	0.94
89	1.03	1.02	0.92	0.95
90	1.03	1.02	0.92	0.95
91	1.03	1.01	0.93	0.95
92	1.03	1.01	0.93	0.96
93	1.03	1.01	0.94	0.97
94	1.03	1.01	0.94	0.97
95	1.03	1.01	0.95	0.98
96	1.03	1.00	0.95	0.99
97	1.03	1.00	0.96	0.99
98	1.03	1.00	0.96	1.00
99	1.03	1.00	0.97	1.00
100	1.03	1.00	0.97	1.00
101	1.03	1.00	0.98	1.01
102	1.03	1.00	0.98	1.01
103	1.03	1.00	0.98	1.01
104	1.02	1.00	0.99	1.01
105	1.02	1.00	0.99	1.01
106	1.02	1.00	0.99	1.01
107	1.02	1.00	0.99	1.01
108	1.02	1.00	0.99	1.01
109	1.02	1.00	0.99	1.01
110	1.01	1.00	1.00	1.01
120	1.00	1.00	1.00	1.00

\* Mortality ratios are ratios of mortality rates to overall OAS levels.

**Table 37 Life Table of Beneficiaries Born In Canada (2007)**

Age	Males				Females			
	$l_x$	$q_x$	$d_x$	$e_x$	$l_x$	$q_x$	$d_x$	$e_x$
65	100,000	0.0154	1,538	17.34	100,000	0.0095	953	20.59
66	98,462	0.0169	1,668	16.60	99,047	0.0105	1,045	19.79
67	96,794	0.0186	1,802	15.88	98,002	0.0117	1,142	18.99
68	94,992	0.0204	1,938	15.17	96,860	0.0129	1,245	18.21
69	93,054	0.0223	2,076	14.48	95,615	0.0141	1,353	17.44
70	90,978	0.0244	2,220	13.79	94,262	0.0155	1,464	16.68
71	88,758	0.0267	2,370	13.13	92,798	0.0170	1,580	15.94
72	86,388	0.0293	2,531	12.47	91,218	0.0187	1,702	15.21
73	83,857	0.0322	2,701	11.83	89,516	0.0204	1,829	14.49
74	81,156	0.0355	2,879	11.21	87,687	0.0224	1,966	13.78
75	78,277	0.0391	3,060	10.61	85,721	0.0246	2,113	13.08
76	75,217	0.0431	3,244	10.02	83,608	0.0272	2,272	12.40
77	71,973	0.0476	3,427	9.45	81,336	0.0300	2,444	11.73
78	68,546	0.0526	3,606	8.89	78,892	0.0333	2,627	11.08
79	64,940	0.0582	3,778	8.36	76,265	0.0370	2,820	10.45
80	61,162	0.0644	3,939	7.85	73,445	0.0411	3,022	9.83
81	57,223	0.0713	4,082	7.35	70,423	0.0459	3,231	9.23
82	53,141	0.0791	4,201	6.88	67,192	0.0513	3,445	8.65
83	48,940	0.0877	4,290	6.42	63,747	0.0574	3,660	8.09
84	44,650	0.0972	4,340	5.99	60,087	0.0644	3,872	7.55
85	40,310	0.1078	4,345	5.58	56,215	0.0724	4,072	7.04
86	35,965	0.1194	4,296	5.20	52,143	0.0815	4,250	6.55
87	31,669	0.1322	4,187	4.84	47,893	0.0917	4,391	6.08
88	27,482	0.1461	4,014	4.50	43,502	0.1030	4,481	5.65
89	23,468	0.1610	3,778	4.18	39,021	0.1155	4,506	5.24
90	19,690	0.1769	3,484	3.89	34,515	0.1291	4,454	4.86
91	16,206	0.1938	3,141	3.62	30,061	0.1438	4,321	4.50
92	13,065	0.2116	2,764	3.36	25,740	0.1595	4,106	4.17
93	10,301	0.2301	2,370	3.13	21,634	0.1763	3,813	3.87
94	7,931	0.2493	1,977	2.92	17,821	0.1939	3,456	3.59
95	5,954	0.2692	1,603	2.72	14,365	0.2124	3,052	3.33
96	4,351	0.2897	1,261	2.54	11,313	0.2317	2,621	3.10
97	3,090	0.3109	961	2.38	8,692	0.2517	2,188	2.88
98	2,129	0.3327	708	2.22	6,504	0.2726	1,773	2.68
99	1,421	0.3549	504	2.08	4,731	0.2941	1,392	2.50
100	917	0.3776	346	1.95	3,339	0.3163	1,056	2.33
101	571	0.4004	229	1.84	2,283	0.3389	774	2.18
102	342	0.4234	145	1.73	1,509	0.3618	546	2.04
103	197	0.4465	88	1.63	963	0.3849	371	1.91
104	109	0.4693	51	1.54	592	0.4081	242	1.80
105	58	0.4919	29	1.46	350	0.4312	151	1.69
106	29	0.5141	15	1.38	199	0.4540	90	1.60
107	14	0.5357	8	1.31	109	0.4763	52	1.52
108	6	0.5566	3	1.25	57	0.4980	28	1.44
109	3	0.5766	2	1.20	29	0.5189	15	1.37
110	1	0.5955	1	1.15	14	0.5389	8	1.31
111	0	0.6133	0	1.11	6	0.5576	3	1.26
112	0	0.6297	0	1.07	3	0.5750	2	1.21
113	0	0.6447	0	1.04	1	0.5909	1	1.17
114	0	0.6581	0	1.01	0	0.6052	0	1.13
115	0	0.6698	0	0.98	0	0.6177	0	1.10
120	0	0.7000	0	0.80	0	0.6500	0	0.85

**Table 38 Life Table of Beneficiaries Born Outside Canada (2007)**

Age	Males				Females			
	$l_x$	$q_x$	$d_x$	$e_x$	$l_x$	$q_x$	$d_x$	$e_x$
65	100,000	0.0104	1,038	19.08	100,000	0.0062	619	22.11
66	98,962	0.0115	1,138	18.27	99,381	0.0067	664	21.25
67	97,824	0.0127	1,246	17.48	98,717	0.0073	721	20.39
68	96,578	0.0141	1,363	16.70	97,996	0.0081	789	19.53
69	95,215	0.0157	1,490	15.93	97,207	0.0089	870	18.69
70	93,725	0.0174	1,628	15.18	96,337	0.0100	964	17.85
71	92,097	0.0193	1,777	14.44	95,373	0.0112	1,072	17.03
72	90,320	0.0215	1,941	13.71	94,301	0.0127	1,195	16.21
73	88,379	0.0240	2,118	13.00	93,106	0.0143	1,334	15.42
74	86,261	0.0268	2,311	12.31	91,772	0.0162	1,487	14.63
75	83,950	0.0300	2,518	11.63	90,285	0.0184	1,657	13.87
76	81,432	0.0336	2,738	10.98	88,628	0.0208	1,844	13.12
77	78,694	0.0377	2,969	10.34	86,784	0.0236	2,049	12.38
78	75,725	0.0423	3,207	9.73	84,735	0.0268	2,273	11.67
79	72,518	0.0475	3,447	9.14	82,462	0.0305	2,515	10.98
80	69,071	0.0533	3,683	8.57	79,947	0.0347	2,776	10.31
81	65,388	0.0598	3,912	8.02	77,171	0.0395	3,051	9.66
82	61,476	0.0671	4,124	7.50	74,120	0.0450	3,336	9.04
83	57,352	0.0751	4,307	7.00	70,784	0.0512	3,624	8.44
84	53,045	0.0839	4,453	6.53	67,160	0.0582	3,907	7.87
85	48,592	0.0937	4,551	6.08	63,253	0.0660	4,174	7.32
86	44,041	0.1043	4,595	5.66	59,079	0.0747	4,415	6.81
87	39,446	0.1161	4,578	5.26	54,664	0.0845	4,619	6.32
88	34,868	0.1289	4,496	4.89	50,045	0.0954	4,773	5.85
89	30,372	0.1430	4,342	4.54	45,272	0.1074	4,864	5.42
90	26,030	0.1581	4,116	4.21	40,408	0.1207	4,878	5.01
91	21,914	0.1744	3,823	3.91	35,530	0.1353	4,808	4.63
92	18,091	0.1917	3,469	3.63	30,722	0.1512	4,646	4.27
93	14,622	0.2100	3,070	3.37	26,076	0.1684	4,392	3.95
94	11,552	0.2290	2,645	3.14	21,684	0.1869	4,053	3.64
95	8,907	0.2487	2,215	2.92	17,631	0.2066	3,642	3.37
96	6,692	0.2689	1,800	2.72	13,989	0.2273	3,180	3.11
97	4,892	0.2900	1,418	2.53	10,809	0.2490	2,691	2.88
98	3,474	0.3117	1,083	2.36	8,118	0.2714	2,204	2.67
99	2,391	0.3341	799	2.21	5,914	0.2946	1,742	2.48
100	1,592	0.3570	568	2.07	4,172	0.3182	1,328	2.31
101	1,024	0.3803	389	1.93	2,844	0.3422	973	2.15
102	635	0.4039	256	1.81	1,871	0.3665	686	2.01
103	379	0.4277	162	1.70	1,185	0.3908	463	1.88
104	217	0.4515	98	1.60	722	0.4149	300	1.76
105	119	0.4751	57	1.51	422	0.4387	185	1.66
106	62	0.4985	31	1.43	237	0.4620	110	1.57
107	31	0.5213	16	1.36	127	0.4847	62	1.48
108	15	0.5436	8	1.29	65	0.5064	33	1.41
109	7	0.5650	4	1.23	32	0.5271	17	1.35
110	3	0.5854	2	1.17	15	0.5466	8	1.29
111	1	0.6046	1	1.13	7	0.5647	4	1.24
112	0	0.6225	0	1.08	3	0.5814	2	1.19
113	0	0.6388	0	1.05	1	0.5964	1	1.16
114	0	0.6536	0	1.02	0	0.6097	0	1.12
115	0	0.6665	0	0.99	0	0.6212	0	1.10
120	0	0.7000	0	0.80	0	0.6500	0	0.85

**Table 39 Deaths by Type of Benefit (2005-2009)**

Age	Without GIS		With GIS		OAS Program	
	Males	Females	Males	Females	Males	Females
65	5,623	3,450	3,278	2,309	8,900	5,759
66	5,864	3,691	3,885	2,737	9,749	6,428
67	6,051	3,733	4,164	2,907	10,215	6,640
68	6,273	3,808	4,558	3,340	10,831	7,147
69	6,371	3,938	4,757	3,506	11,128	7,444
70	6,770	4,232	5,054	3,776	11,823	8,008
71	7,082	4,468	5,069	4,142	12,151	8,610
72	7,710	4,858	5,407	4,444	13,117	9,302
73	8,561	5,249	5,538	4,780	14,099	10,029
74	8,987	5,612	6,181	5,335	15,168	10,947
75	9,696	5,916	6,351	5,870	16,047	11,785
76	10,229	6,381	6,594	6,380	16,822	12,761
77	10,933	6,949	6,828	7,041	17,760	13,990
78	11,306	7,299	7,065	7,541	18,371	14,840
79	11,528	7,824	7,256	8,215	18,783	16,039
80	12,012	8,290	7,122	8,856	19,134	17,146
81	12,185	8,661	7,086	9,592	19,271	18,253
82	12,415	9,381	7,120	10,384	19,535	19,765
83	12,512	9,612	7,100	10,949	19,612	20,561
84	12,328	10,179	6,820	11,663	19,148	21,842
85	12,001	10,208	6,488	12,290	18,489	22,497
86	11,106	9,915	6,100	12,286	17,206	22,201
87	9,988	9,604	5,986	12,753	15,974	22,357
88	8,788	8,807	5,406	12,486	14,194	21,293
89	7,591	8,125	4,975	12,446	12,565	20,571
90	6,550	7,516	4,555	11,780	11,105	19,296
91	5,837	6,980	4,141	11,586	9,978	18,565
92	4,772	6,201	3,585	10,853	8,357	17,054
93	3,883	5,419	3,146	9,861	7,029	15,280
94	2,992	4,473	2,544	8,770	5,535	13,242
95	2,121	3,718	2,023	7,592	4,143	11,310
96	1,550	2,867	1,540	6,135	3,090	9,002
97	1,039	2,166	1,168	4,976	2,207	7,141
98	729	1,645	813	3,954	1,541	5,599
99	469	1,075	604	2,832	1,073	3,907
100	293	749	406	2,129	699	2,878
101	181	546	230	1,466	410	2,012
102	94	346	144	940	238	1,285
103	56	203	84	624	139	826
104	35	114	52	394	87	508
105	15	65	39	239	54	304
106	13	29	15	135	28	164
107	3	15	5	76	8	91
108	4	12	5	47	9	58
109	1	7	2	17	3	24
110+	0	5	1	20	1	25
Total	264,536	214,330	171,277	270,442	435,813	484,772



**Table 40 Exposures by Type of Benefit (2005-2009)**

Age	Without GIS		With GIS		OAS Program	
	Males	Females	Males	Females	Males	Females
65	483,225	481,750	151,209	187,592	634,433	669,341
66	468,469	468,581	163,644	200,758	632,114	669,340
67	432,890	433,805	165,522	204,416	598,412	638,221
68	402,592	404,665	165,580	207,049	568,172	611,714
69	380,772	381,926	162,281	207,578	543,053	589,504
70	364,698	365,456	156,414	205,824	521,112	571,280
71	349,046	350,482	150,557	203,219	499,603	553,702
72	335,826	337,996	145,828	202,195	481,653	540,191
73	324,862	327,913	142,215	203,108	467,077	531,021
74	312,446	317,153	138,174	204,322	450,620	521,475
75	299,220	306,132	133,859	204,834	433,079	510,965
76	283,708	293,881	128,462	204,744	412,170	498,624
77	266,692	280,134	122,060	203,823	388,752	483,957
78	246,864	264,743	114,746	201,215	361,610	465,958
79	226,632	249,071	106,868	197,731	333,500	446,802
80	207,107	233,998	97,916	193,281	305,023	427,279
81	188,221	219,529	89,315	188,343	277,537	407,872
82	169,160	203,953	80,306	181,521	249,466	385,474
83	151,331	188,315	71,799	174,836	223,130	363,151
84	132,936	170,254	63,426	166,222	196,362	336,476
85	114,539	151,163	55,708	156,211	170,247	307,374
86	94,612	128,820	47,630	142,402	142,242	271,222
87	76,569	107,580	40,644	128,197	117,213	235,777
88	60,338	88,177	33,987	113,109	94,326	201,286
89	46,835	71,752	28,157	98,565	74,992	170,317
90	35,972	57,737	23,208	84,964	59,180	142,700
91	28,019	47,365	19,098	73,582	47,117	120,946
92	21,227	37,724	15,280	62,176	36,507	99,900
93	15,420	29,234	11,948	51,259	27,368	80,492
94	10,831	22,030	9,002	41,005	19,833	63,035
95	7,258	15,942	6,619	31,517	13,877	47,459
96	4,721	11,124	4,680	23,657	9,401	34,782
97	2,984	7,712	3,219	17,177	6,203	24,888
98	1,849	5,189	2,137	11,983	3,987	17,173
99	1,098	3,333	1,403	8,181	2,501	11,514
100	644	2,113	826	5,430	1,471	7,543
101	357	1,294	493	3,423	850	4,717
102	203	722	292	2,136	495	2,857
103	113	405	168	1,296	281	1,701
104	58	218	94	782	152	1,001
105	29	116	50	440	80	556
106	16	62	16	233	32	295
107	7	40	7	130	14	170
108	3	22	3	66	7	88
109	1	13	1	32	2	45
110+	2	13	4	27	6	41
<b>Total</b>	<b>6,550,403</b>	<b>7,069,637</b>	<b>2,854,858</b>	<b>5,000,587</b>	<b>9,405,260</b>	<b>12,070,224</b>

**Table 41 Mortality Rates by Type of Benefit (2007)**

Age	Without GIS		With GIS		OAS Program	
	Males	Females	Males	Females	Males	Females
65	0.0116	0.0072	0.0215	0.0123	0.0140	0.0086
66	0.0126	0.0078	0.0232	0.0133	0.0154	0.0095
67	0.0138	0.0085	0.0250	0.0144	0.0169	0.0104
68	0.0152	0.0094	0.0269	0.0156	0.0186	0.0115
69	0.0167	0.0104	0.0290	0.0169	0.0203	0.0127
70	0.0184	0.0115	0.0312	0.0183	0.0223	0.0140
71	0.0205	0.0128	0.0336	0.0199	0.0245	0.0154
72	0.0228	0.0141	0.0363	0.0217	0.0269	0.0170
73	0.0255	0.0157	0.0393	0.0236	0.0297	0.0187
74	0.0285	0.0174	0.0426	0.0257	0.0328	0.0207
75	0.0318	0.0194	0.0463	0.0281	0.0363	0.0229
76	0.0356	0.0217	0.0503	0.0307	0.0402	0.0254
77	0.0399	0.0243	0.0547	0.0337	0.0446	0.0282
78	0.0447	0.0272	0.0596	0.0370	0.0494	0.0315
79	0.0501	0.0307	0.0649	0.0407	0.0548	0.0351
80	0.0562	0.0346	0.0708	0.0449	0.0609	0.0393
81	0.0631	0.0392	0.0773	0.0496	0.0677	0.0440
82	0.0708	0.0445	0.0846	0.0549	0.0752	0.0494
83	0.0793	0.0506	0.0927	0.0609	0.0837	0.0556
84	0.0889	0.0577	0.1017	0.0678	0.0931	0.0627
85	0.0994	0.0657	0.1117	0.0755	0.1035	0.0707
86	0.1110	0.0747	0.1228	0.0843	0.1150	0.0798
87	0.1236	0.0849	0.1350	0.0942	0.1276	0.0899
88	0.1373	0.0962	0.1483	0.1051	0.1413	0.1012
89	0.1521	0.1086	0.1627	0.1172	0.1561	0.1136
90	0.1680	0.1221	0.1779	0.1304	0.1718	0.1271
91	0.1847	0.1368	0.1941	0.1448	0.1885	0.1417
92	0.2023	0.1526	0.2109	0.1602	0.2060	0.1575
93	0.2206	0.1694	0.2284	0.1768	0.2241	0.1743
94	0.2396	0.1872	0.2465	0.1945	0.2428	0.1921
95	0.2591	0.2060	0.2650	0.2132	0.2621	0.2109
96	0.2791	0.2258	0.2840	0.2328	0.2818	0.2305
97	0.2998	0.2465	0.3036	0.2533	0.3022	0.2511
98	0.3212	0.2680	0.3240	0.2745	0.3233	0.2723
99	0.3431	0.2903	0.3449	0.2964	0.3449	0.2943
100	0.3656	0.3131	0.3664	0.3188	0.3671	0.3169
101	0.3884	0.3364	0.3883	0.3417	0.3896	0.3399
102	0.4115	0.3600	0.4105	0.3649	0.4124	0.3631
103	0.4347	0.3837	0.4330	0.3882	0.4353	0.3866
104	0.4579	0.4075	0.4556	0.4115	0.4583	0.4100
105	0.4809	0.4311	0.4781	0.4347	0.4811	0.4333
106	0.5037	0.4543	0.5005	0.4575	0.5036	0.4563
107	0.5259	0.4771	0.5225	0.4797	0.5258	0.4787
108	0.5476	0.4990	0.5440	0.5013	0.5473	0.5004
109	0.5684	0.5201	0.5648	0.5220	0.5680	0.5212
110	0.5882	0.5402	0.5847	0.5417	0.5878	0.5410
120	0.7000	0.6500	0.7000	0.6500	0.7000	0.6500

**Table 42 Mortality Ratios by Type of Benefit (2007)\***

Age	Without GIS		With GIS	
	Males	Females	Males	Females
65	0.83	0.83	1.54	1.43
66	0.82	0.82	1.51	1.40
67	0.82	0.82	1.48	1.38
68	0.82	0.82	1.45	1.36
69	0.82	0.82	1.42	1.34
70	0.83	0.82	1.40	1.31
71	0.84	0.83	1.37	1.29
72	0.85	0.83	1.35	1.28
73	0.86	0.84	1.32	1.26
74	0.87	0.84	1.30	1.24
75	0.88	0.85	1.27	1.23
76	0.89	0.85	1.25	1.21
77	0.89	0.86	1.23	1.19
78	0.90	0.87	1.21	1.18
79	0.91	0.87	1.18	1.16
80	0.92	0.88	1.16	1.14
81	0.93	0.89	1.14	1.13
82	0.94	0.90	1.12	1.11
83	0.95	0.91	1.11	1.10
84	0.95	0.92	1.09	1.08
85	0.96	0.93	1.08	1.07
86	0.96	0.94	1.07	1.06
87	0.97	0.94	1.06	1.05
88	0.97	0.95	1.05	1.04
89	0.97	0.96	1.04	1.03
90	0.98	0.96	1.04	1.03
91	0.98	0.97	1.03	1.02
92	0.98	0.97	1.02	1.02
93	0.98	0.97	1.02	1.01
94	0.99	0.97	1.02	1.01
95	0.99	0.98	1.01	1.01
96	0.99	0.98	1.01	1.01
97	0.99	0.98	1.00	1.01
98	0.99	0.98	1.00	1.01
99	0.99	0.99	1.00	1.01
100	1.00	0.99	1.00	1.01
101	1.00	0.99	1.00	1.01
102	1.00	0.99	1.00	1.00
103	1.00	0.99	0.99	1.00
104	1.00	0.99	0.99	1.00
105	1.00	0.99	0.99	1.00
106	1.00	1.00	0.99	1.00
107	1.00	1.00	0.99	1.00
108	1.00	1.00	0.99	1.00
109	1.00	1.00	0.99	1.00
110	1.00	1.00	0.99	1.00
120	1.00	1.00	1.00	1.00

\* Mortality ratios are ratios of mortality rates to overall OAS levels.

**Table 43 Life Table of Beneficiaries without GIS (2007)**

Age	Males				Females			
	$l_x$	$q_x$	$d_x$	$e_x$	$l_x$	$q_x$	$d_x$	$e_x$
65	100,000	0.0116	1,161	18.62	100,000	0.0072	719	21.85
66	98,839	0.0126	1,247	17.84	99,281	0.0078	775	21.01
67	97,592	0.0138	1,347	17.06	98,506	0.0085	842	20.17
68	96,245	0.0152	1,458	16.29	97,664	0.0094	918	19.34
69	94,787	0.0167	1,582	15.53	96,746	0.0104	1,005	18.52
70	93,205	0.0184	1,720	14.79	95,741	0.0115	1,101	17.71
71	91,485	0.0205	1,873	14.06	94,640	0.0128	1,207	16.91
72	89,612	0.0228	2,044	13.34	93,433	0.0141	1,322	16.12
73	87,568	0.0255	2,230	12.64	92,111	0.0157	1,446	15.34
74	85,338	0.0285	2,428	11.96	90,665	0.0174	1,582	14.58
75	82,910	0.0318	2,639	11.29	89,083	0.0194	1,730	13.83
76	80,271	0.0356	2,859	10.65	87,353	0.0217	1,893	13.09
77	77,412	0.0399	3,088	10.02	85,460	0.0243	2,074	12.37
78	74,324	0.0447	3,322	9.42	83,386	0.0272	2,272	11.67
79	71,002	0.0501	3,558	8.84	81,114	0.0307	2,488	10.98
80	67,444	0.0562	3,791	8.27	78,626	0.0346	2,723	10.31
81	63,653	0.0631	4,014	7.74	75,903	0.0392	2,976	9.66
82	59,639	0.0708	4,220	7.22	72,927	0.0445	3,246	9.04
83	55,419	0.0793	4,397	6.74	69,681	0.0506	3,528	8.44
84	51,022	0.0889	4,534	6.27	66,153	0.0577	3,815	7.86
85	46,488	0.0994	4,621	5.84	62,338	0.0657	4,095	7.31
86	41,867	0.1110	4,646	5.43	58,243	0.0747	4,354	6.79
87	37,221	0.1236	4,601	5.04	53,889	0.0849	4,575	6.30
88	32,620	0.1373	4,480	4.68	49,314	0.0962	4,743	5.84
89	28,140	0.1521	4,281	4.35	44,571	0.1086	4,840	5.40
90	23,859	0.1680	4,007	4.04	39,731	0.1221	4,853	5.00
91	19,852	0.1847	3,667	3.75	34,878	0.1368	4,772	4.63
92	16,185	0.2023	3,274	3.49	30,106	0.1526	4,593	4.28
93	12,911	0.2206	2,848	3.25	25,513	0.1694	4,321	3.96
94	10,063	0.2396	2,411	3.03	21,192	0.1872	3,967	3.67
95	7,652	0.2591	1,982	2.82	17,225	0.2060	3,549	3.40
96	5,670	0.2791	1,582	2.64	13,676	0.2258	3,089	3.15
97	4,088	0.2998	1,226	2.46	10,587	0.2465	2,610	2.92
98	2,862	0.3212	919	2.30	7,977	0.2680	2,138	2.71
99	1,943	0.3431	667	2.15	5,839	0.2903	1,695	2.52
100	1,276	0.3656	466	2.02	4,144	0.3131	1,297	2.35
101	810	0.3884	315	1.89	2,847	0.3364	958	2.19
102	495	0.4115	204	1.78	1,889	0.3600	680	2.05
103	291	0.4347	126	1.68	1,209	0.3837	464	1.92
104	165	0.4579	76	1.58	745	0.4075	304	1.80
105	89	0.4809	43	1.49	441	0.4311	190	1.69
106	46	0.5037	23	1.41	251	0.4543	114	1.60
107	23	0.5259	12	1.34	137	0.4771	65	1.51
108	11	0.5476	6	1.28	72	0.4990	36	1.44
109	5	0.5684	3	1.22	36	0.5201	19	1.37
110	2	0.5882	1	1.17	17	0.5402	9	1.31
111	1	0.6070	1	1.12	8	0.5589	4	1.25
112	0	0.6244	0	1.08	4	0.5763	2	1.21
113	0	0.6403	0	1.04	2	0.5921	1	1.17
114	0	0.6546	0	1.01	1	0.6062	1	1.13
115	0	0.6672	0	0.99	0	0.6185	0	1.10
120	0	0.7000	0	0.80	0	0.6500	0	0.85



Table 44 Life Table of Beneficiaries with GIS (2007)

Age	Males				Females			
	$l_x$	$q_x$	$d_x$	$e_x$	$l_x$	$q_x$	$d_x$	$e_x$
65	100,000	0.0215	2,155	16.17	100,000	0.0123	1,233	19.83
66	97,845	0.0232	2,273	15.52	98,767	0.0133	1,316	19.07
67	95,572	0.0250	2,392	14.87	97,451	0.0144	1,404	18.32
68	93,180	0.0269	2,510	14.24	96,047	0.0156	1,499	17.59
69	90,670	0.0290	2,628	13.62	94,548	0.0169	1,599	16.86
70	88,042	0.0312	2,747	13.01	92,949	0.0183	1,705	16.14
71	85,295	0.0336	2,867	12.42	91,244	0.0199	1,817	15.43
72	82,428	0.0363	2,992	11.83	89,427	0.0217	1,936	14.73
73	79,436	0.0393	3,121	11.26	87,491	0.0236	2,063	14.05
74	76,315	0.0426	3,252	10.70	85,428	0.0257	2,196	13.38
75	73,063	0.0463	3,381	10.15	83,232	0.0281	2,338	12.72
76	69,682	0.0503	3,504	9.62	80,894	0.0307	2,486	12.07
77	66,178	0.0547	3,620	9.10	78,408	0.0337	2,641	11.44
78	62,558	0.0596	3,726	8.60	75,767	0.0370	2,802	10.82
79	58,832	0.0649	3,818	8.11	72,965	0.0407	2,969	10.21
80	55,014	0.0708	3,894	7.64	69,996	0.0449	3,140	9.62
81	51,120	0.0773	3,953	7.19	66,856	0.0496	3,315	9.05
82	47,167	0.0846	3,992	6.75	63,541	0.0549	3,489	8.50
83	43,175	0.0927	4,004	6.33	60,052	0.0609	3,659	7.96
84	39,171	0.1017	3,985	5.92	56,393	0.0678	3,822	7.45
85	35,186	0.1117	3,932	5.53	52,571	0.0755	3,971	6.95
86	31,254	0.1228	3,839	5.17	48,600	0.0843	4,098	6.48
87	27,415	0.1350	3,702	4.82	44,502	0.0942	4,191	6.03
88	23,713	0.1483	3,517	4.50	40,311	0.1051	4,239	5.61
89	20,196	0.1627	3,285	4.19	36,072	0.1172	4,229	5.21
90	16,911	0.1779	3,009	3.91	31,843	0.1304	4,154	4.83
91	13,902	0.1941	2,698	3.65	27,689	0.1448	4,009	4.48
92	11,204	0.2109	2,363	3.40	23,680	0.1602	3,794	4.16
93	8,841	0.2284	2,020	3.18	19,886	0.1768	3,516	3.85
94	6,821	0.2465	1,681	2.97	16,370	0.1945	3,183	3.57
95	5,140	0.2650	1,362	2.78	13,187	0.2132	2,811	3.32
96	3,778	0.2840	1,073	2.61	10,376	0.2328	2,415	3.08
97	2,705	0.3036	821	2.44	7,961	0.2533	2,016	2.86
98	1,884	0.3240	610	2.29	5,945	0.2745	1,632	2.66
99	1,274	0.3449	439	2.15	4,313	0.2964	1,278	2.48
100	835	0.3664	306	2.02	3,035	0.3188	968	2.31
101	529	0.3883	205	1.90	2,067	0.3417	706	2.16
102	324	0.4105	133	1.79	1,361	0.3649	497	2.02
103	191	0.4330	83	1.69	864	0.3882	335	1.90
104	108	0.4556	49	1.59	529	0.4115	218	1.78
105	59	0.4781	28	1.51	311	0.4347	135	1.68
106	31	0.5005	16	1.43	176	0.4575	81	1.59
107	15	0.5225	8	1.35	95	0.4797	46	1.50
108	7	0.5440	4	1.29	49	0.5013	25	1.43
109	3	0.5648	2	1.23	24	0.5220	13	1.36
110	1	0.5847	1	1.18	11	0.5417	6	1.30
111	0	0.6037	0	1.13	5	0.5601	3	1.25
112	0	0.6214	0	1.09	2	0.5772	1	1.20
113	0	0.6377	0	1.05	1	0.5928	1	1.16
114	0	0.6525	0	1.02	0	0.6067	0	1.13
115	0	0.6655	0	0.99	0	0.6188	0	1.10
120	0	0.7000	0	0.80	0	0.6500	0	0.85

**Table 45 Beneficiaries by Age, Sex, and Marital Status (2009)**

Age	Married		Single		OAS Program	
	Males	Females	Males	Females	Males	Females
65	101,397	90,568	32,743	50,531	134,140	141,099
66	109,503	96,025	34,963	55,396	144,466	151,421
67	104,249	89,101	32,854	54,687	137,103	143,788
68	95,331	81,789	30,594	51,982	125,925	133,771
69	91,438	77,493	29,109	51,962	120,547	129,455
70	85,792	71,348	26,573	50,630	112,365	121,978
71	83,216	67,697	26,161	51,236	109,377	118,933
72	77,137	62,146	24,543	50,413	101,680	112,559
73	74,462	58,801	24,100	50,929	98,562	109,730
74	70,838	54,874	23,527	52,384	94,365	107,258
75	67,245	50,638	22,749	53,287	89,994	103,925
76	63,853	46,832	22,556	53,405	86,409	100,237
77	62,252	44,529	22,832	56,805	85,084	101,334
78	58,496	40,599	22,061	57,693	80,557	98,292
79	55,359	37,216	21,880	59,144	77,239	96,360
80	48,233	31,943	20,300	57,427	68,533	89,370
81	44,299	28,440	19,836	58,192	64,135	86,632
82	39,318	24,660	18,733	57,565	58,051	82,225
83	34,556	21,227	17,719	56,697	52,275	77,924
84	30,344	18,091	16,822	56,213	47,166	74,304
85	25,920	14,872	15,430	54,294	41,350	69,166
86	21,681	12,221	14,003	50,938	35,684	63,159
87	18,422	9,704	12,785	48,483	31,207	58,187
88	15,280	7,533	11,677	44,762	26,957	52,295
89	12,006	5,683	10,110	40,504	22,116	46,187
90	8,011	3,568	7,661	31,914	15,672	35,482
91	6,029	2,471	6,438	27,622	12,467	30,093
92	4,522	1,678	5,280	22,904	9,802	24,582
93	3,254	1,193	4,367	19,497	7,621	20,690
94	2,336	774	3,525	16,326	5,861	17,100
95	1,588	555	2,783	13,302	4,371	13,857
96	1,059	326	2,115	10,028	3,174	10,354
97	653	211	1,442	7,543	2,095	7,754
98	396	135	952	5,288	1,348	5,423
99	229	72	633	3,729	862	3,801
100+	249	61	1,065	6,662	1,314	6,723
Total	1,518,953	1,155,074	590,921	1,490,374	2,109,874	2,645,448

**Table 46 Exposures by Age, Sex, and Marital Status (2005-2009)**

Age	Married		Single		OAS Program	
	Males	Females	Males	Females	Males	Females
65	482,825	424,627	151,609	244,714	634,433	669,341
66	482,421	417,880	149,692	251,460	632,114	669,340
67	456,980	391,023	141,431	247,198	598,412	638,221
68	434,233	367,365	133,939	244,348	568,172	611,714
69	415,254	345,323	127,799	244,181	543,053	589,504
70	397,837	325,591	123,275	245,689	521,112	571,280
71	380,029	305,635	119,574	248,067	499,603	553,702
72	364,877	287,875	116,776	252,316	481,653	540,191
73	352,126	271,541	114,951	259,480	467,077	531,021
74	337,560	254,438	113,059	267,037	450,620	521,475
75	321,628	237,158	111,451	273,808	433,079	510,965
76	303,298	218,782	108,872	279,843	412,170	498,624
77	282,876	199,614	105,876	284,343	388,752	483,957
78	259,768	179,347	101,842	286,610	361,610	465,958
79	235,986	159,413	97,515	287,389	333,500	446,802
80	212,217	140,380	92,806	286,899	305,023	427,279
81	189,529	122,726	88,008	285,145	277,537	407,872
82	166,876	105,165	82,590	280,309	249,466	385,474
83	145,663	89,166	77,467	273,985	223,130	363,151
84	125,106	73,638	71,256	262,838	196,362	336,476
85	105,636	59,478	64,612	247,896	170,247	307,374
86	85,417	45,729	56,826	225,493	142,242	271,222
87	67,642	34,124	49,571	201,653	117,213	235,777
88	52,010	24,738	42,316	176,548	94,326	201,286
89	39,280	17,622	35,711	152,695	74,992	170,317
90	29,273	12,306	29,907	130,394	59,180	142,700
91	22,069	8,747	25,048	112,199	47,117	120,946
92	15,962	6,031	20,545	93,869	36,507	99,900
93	11,144	4,011	16,224	76,481	27,368	80,492
94	7,477	2,630	12,356	60,405	19,833	63,035
95	4,834	1,621	9,043	45,838	13,877	47,459
96	3,023	933	6,378	33,849	9,401	34,782
97	1,798	532	4,405	24,356	6,203	24,888
98	1,019	286	2,967	16,887	3,987	17,173
99	556	134	1,945	11,379	2,501	11,514
100	299	71	1,172	7,472	1,471	7,543
101	147	34	703	4,683	850	4,717
102	70	13	425	2,845	495	2,857
103	35	8	246	1,693	281	1,701
104	21	4	131	997	152	1,001
105	12	2	68	554	80	556
106	3	2	30	293	32	295
107	1	1	13	168	14	170
108	1	0	5	88	7	88
109	2	0	1	45	2	45
110+	1	0	5	41	6	41
Total	6,794,820	5,135,746	2,610,441	6,934,478	9,405,260	12,070,224

**Table 47 Mortality Rates by Age, Sex, and Marital Status (2007)**

Age	Married		Single		OAS Program	
	Males	Females	Males	Females	Males	Females
65	0.0110	0.0069	0.0237	0.0117	0.0140	0.0086
66	0.0122	0.0076	0.0256	0.0126	0.0154	0.0095
67	0.0136	0.0084	0.0277	0.0137	0.0169	0.0104
68	0.0151	0.0092	0.0299	0.0149	0.0186	0.0115
69	0.0166	0.0102	0.0322	0.0161	0.0203	0.0127
70	0.0184	0.0113	0.0347	0.0175	0.0223	0.0140
71	0.0204	0.0125	0.0374	0.0190	0.0245	0.0154
72	0.0226	0.0138	0.0404	0.0206	0.0269	0.0170
73	0.0251	0.0153	0.0436	0.0224	0.0297	0.0187
74	0.0280	0.0169	0.0472	0.0243	0.0328	0.0207
75	0.0312	0.0187	0.0510	0.0265	0.0363	0.0229
76	0.0348	0.0208	0.0553	0.0290	0.0402	0.0254
77	0.0388	0.0233	0.0599	0.0317	0.0446	0.0282
78	0.0433	0.0261	0.0649	0.0348	0.0494	0.0315
79	0.0483	0.0294	0.0703	0.0383	0.0548	0.0351
80	0.0541	0.0332	0.0763	0.0422	0.0609	0.0393
81	0.0605	0.0377	0.0829	0.0467	0.0677	0.0440
82	0.0678	0.0429	0.0902	0.0518	0.0752	0.0494
83	0.0759	0.0491	0.0982	0.0577	0.0837	0.0556
84	0.0851	0.0562	0.1071	0.0645	0.0931	0.0627
85	0.0952	0.0644	0.1168	0.0722	0.1035	0.0707
86	0.1065	0.0738	0.1275	0.0810	0.1150	0.0798
87	0.1189	0.0845	0.1392	0.0909	0.1276	0.0899
88	0.1323	0.0966	0.1520	0.1019	0.1413	0.1012
89	0.1469	0.1100	0.1659	0.1140	0.1561	0.1136
90	0.1625	0.1248	0.1808	0.1273	0.1718	0.1271
91	0.1791	0.1411	0.1966	0.1417	0.1885	0.1417
92	0.1966	0.1587	0.2133	0.1573	0.2060	0.1575
93	0.2148	0.1778	0.2307	0.1740	0.2241	0.1743
94	0.2339	0.1983	0.2487	0.1918	0.2428	0.1921
95	0.2537	0.2201	0.2672	0.2106	0.2621	0.2109
96	0.2741	0.2434	0.2862	0.2303	0.2818	0.2305
97	0.2954	0.2675	0.3059	0.2509	0.3022	0.2511
98	0.3173	0.2922	0.3263	0.2722	0.3233	0.2723
99	0.3398	0.3174	0.3472	0.2943	0.3449	0.2943
100	0.3627	0.3429	0.3687	0.3169	0.3671	0.3169
101	0.3861	0.3684	0.3905	0.3399	0.3896	0.3399
102	0.4096	0.3938	0.4127	0.3633	0.4124	0.3631
103	0.4333	0.4187	0.4351	0.3868	0.4353	0.3866
104	0.4569	0.4431	0.4576	0.4102	0.4583	0.4100
105	0.4804	0.4668	0.4800	0.4336	0.4811	0.4333
106	0.5034	0.4894	0.5022	0.4565	0.5036	0.4563
107	0.5260	0.5109	0.5241	0.4789	0.5258	0.4787
108	0.5478	0.5312	0.5455	0.5007	0.5473	0.5004
109	0.5688	0.5500	0.5661	0.5215	0.5680	0.5212
110	0.5888	0.5673	0.5859	0.5413	0.5878	0.5410
120	0.7000	0.6500	0.7000	0.6500	0.7000	0.6500



**Table 48 Mortality Ratios by Age, Sex, and Marital Status (2007)\***

Age	Married		Single	
	Males	Females	Males	Females
65	0.78	0.79	1.69	1.35
66	0.79	0.80	1.66	1.33
67	0.80	0.80	1.64	1.31
68	0.81	0.80	1.61	1.29
69	0.82	0.81	1.59	1.27
70	0.82	0.81	1.56	1.25
71	0.83	0.81	1.53	1.23
72	0.84	0.81	1.50	1.21
73	0.85	0.81	1.47	1.19
74	0.85	0.82	1.44	1.18
75	0.86	0.82	1.40	1.16
76	0.86	0.82	1.37	1.14
77	0.87	0.82	1.34	1.12
78	0.88	0.83	1.31	1.11
79	0.88	0.84	1.28	1.09
80	0.89	0.85	1.25	1.07
81	0.89	0.86	1.23	1.06
82	0.90	0.87	1.20	1.05
83	0.91	0.88	1.17	1.04
84	0.91	0.90	1.15	1.03
85	0.92	0.91	1.13	1.02
86	0.93	0.93	1.11	1.02
87	0.93	0.94	1.09	1.01
88	0.94	0.95	1.08	1.01
89	0.94	0.97	1.06	1.00
90	0.95	0.98	1.05	1.00
91	0.95	1.00	1.04	1.00
92	0.95	1.01	1.04	1.00
93	0.96	1.02	1.03	1.00
94	0.96	1.03	1.02	1.00
95	0.97	1.04	1.02	1.00
96	0.97	1.06	1.02	1.00
97	0.98	1.07	1.01	1.00
98	0.98	1.07	1.01	1.00
99	0.99	1.08	1.01	1.00
100	0.99	1.08	1.00	1.00
101	0.99	1.08	1.00	1.00
102	0.99	1.08	1.00	1.00
103	1.00	1.08	1.00	1.00
104	1.00	1.08	1.00	1.00
105	1.00	1.08	1.00	1.00
106	1.00	1.07	1.00	1.00
107	1.00	1.07	1.00	1.00
108	1.00	1.06	1.00	1.00
109	1.00	1.06	1.00	1.00
110	1.00	1.05	1.00	1.00
120	1.00	1.00	1.00	1.00

\* Mortality ratios are ratios of mortality rates to overall OAS levels.

**Table 49 Life Table of Married Beneficiaries (2007)**

Age	Males				Females			
	$l_x$	$q_x$	$d_x$	$e_x$	$l_x$	$q_x$	$d_x$	$e_x$
65	100,000	0.0110	1,095	18.84	100,000	0.0069	686	21.93
66	98,905	0.0122	1,209	18.04	99,314	0.0076	753	21.08
67	97,696	0.0136	1,327	17.26	98,561	0.0084	826	20.23
68	96,369	0.0151	1,450	16.49	97,735	0.0092	904	19.40
69	94,919	0.0166	1,579	15.73	96,831	0.0102	988	18.58
70	93,340	0.0184	1,717	14.99	95,843	0.0113	1,081	17.76
71	91,623	0.0204	1,866	14.26	94,762	0.0125	1,181	16.96
72	89,757	0.0226	2,028	13.55	93,581	0.0138	1,290	16.17
73	87,729	0.0251	2,205	12.85	92,291	0.0153	1,408	15.39
74	85,524	0.0280	2,393	12.17	90,883	0.0169	1,535	14.62
75	83,131	0.0312	2,592	11.50	89,348	0.0187	1,674	13.86
76	80,539	0.0348	2,799	10.86	87,674	0.0208	1,828	13.12
77	77,740	0.0388	3,014	10.23	85,846	0.0233	1,999	12.38
78	74,726	0.0433	3,234	9.62	83,847	0.0261	2,189	11.67
79	71,492	0.0483	3,456	9.04	81,658	0.0294	2,399	10.97
80	68,036	0.0541	3,678	8.47	79,259	0.0332	2,633	10.28
81	64,358	0.0605	3,894	7.93	76,626	0.0377	2,889	9.62
82	60,464	0.0678	4,098	7.40	73,737	0.0429	3,167	8.98
83	56,366	0.0759	4,280	6.91	70,570	0.0491	3,463	8.36
84	52,086	0.0851	4,430	6.43	67,107	0.0562	3,771	7.76
85	47,656	0.0952	4,538	5.98	63,336	0.0644	4,080	7.19
86	43,118	0.1065	4,591	5.56	59,256	0.0738	4,376	6.66
87	38,527	0.1189	4,579	5.17	54,880	0.0845	4,640	6.15
88	33,948	0.1323	4,493	4.79	50,240	0.0966	4,853	5.67
89	29,455	0.1469	4,327	4.45	45,387	0.1100	4,993	5.22
90	25,128	0.1625	4,084	4.13	40,394	0.1248	5,043	4.80
91	21,044	0.1791	3,769	3.83	35,351	0.1411	4,988	4.42
92	17,275	0.1966	3,395	3.56	30,363	0.1587	4,820	4.06
93	13,880	0.2148	2,982	3.31	25,543	0.1778	4,542	3.73
94	10,898	0.2339	2,549	3.08	21,001	0.1983	4,164	3.43
95	8,349	0.2537	2,118	2.87	16,837	0.2201	3,706	3.16
96	6,231	0.2741	1,708	2.67	13,131	0.2434	3,196	2.91
97	4,523	0.2954	1,336	2.49	9,935	0.2675	2,657	2.68
98	3,187	0.3173	1,011	2.32	7,278	0.2922	2,127	2.48
99	2,176	0.3398	739	2.17	5,151	0.3174	1,635	2.30
100	1,437	0.3627	521	2.03	3,516	0.3429	1,206	2.14
101	916	0.3861	354	1.90	2,310	0.3684	851	1.99
102	562	0.4096	230	1.79	1,459	0.3938	574	1.86
103	332	0.4333	144	1.68	885	0.4187	371	1.74
104	188	0.4569	86	1.58	514	0.4431	228	1.64
105	102	0.4804	49	1.50	286	0.4668	133	1.55
106	53	0.5034	27	1.41	153	0.4894	75	1.47
107	26	0.5260	14	1.34	78	0.5109	40	1.40
108	12	0.5478	7	1.28	38	0.5312	20	1.33
109	5	0.5688	3	1.22	18	0.5500	10	1.28
110	2	0.5888	1	1.17	8	0.5673	5	1.23
111	1	0.6076	1	1.12	3	0.5830	2	1.19
112	0	0.6250	0	1.08	1	0.5971	1	1.15
113	0	0.6409	0	1.04	0	0.6094	0	1.12
114	0	0.6552	0	1.01	0	0.6201	0	1.10
115	0	0.6677	0	0.99	0	0.6290	0	1.08
120	0	0.7000	0	0.80	0	0.6500	0	0.85

**Table 50 Life Table of Single Beneficiaries (2007)**

Age	Males				Females			
	$l_x$	$q_x$	$d_x$	$e_x$	$l_x$	$q_x$	$d_x$	$e_x$
65	100,000	0.0237	2,367	15.53	100,000	0.0117	1,168	20.20
66	97,633	0.0256	2,501	14.89	98,832	0.0126	1,249	19.44
67	95,132	0.0277	2,635	14.27	97,583	0.0137	1,337	18.68
68	92,497	0.0299	2,766	13.66	96,246	0.0149	1,431	17.93
69	89,731	0.0322	2,893	13.07	94,815	0.0161	1,530	17.20
70	86,838	0.0347	3,017	12.49	93,285	0.0175	1,633	16.47
71	83,821	0.0374	3,138	11.92	91,652	0.0190	1,740	15.75
72	80,683	0.0404	3,259	11.36	89,912	0.0206	1,852	15.05
73	77,424	0.0436	3,378	10.82	88,060	0.0224	1,970	14.35
74	74,046	0.0472	3,493	10.29	86,090	0.0243	2,095	13.67
75	70,553	0.0510	3,601	9.78	83,995	0.0265	2,227	13.00
76	66,952	0.0553	3,700	9.28	81,768	0.0290	2,368	12.34
77	63,252	0.0599	3,786	8.79	79,400	0.0317	2,517	11.69
78	59,466	0.0649	3,857	8.32	76,883	0.0348	2,674	11.06
79	55,609	0.0703	3,910	7.86	74,209	0.0383	2,839	10.44
80	51,699	0.0763	3,945	7.42	71,370	0.0422	3,012	9.84
81	47,754	0.0829	3,959	6.99	68,358	0.0467	3,192	9.25
82	43,795	0.0902	3,949	6.57	65,166	0.0518	3,378	8.68
83	39,846	0.0982	3,914	6.18	61,788	0.0577	3,568	8.12
84	35,932	0.1071	3,848	5.79	58,220	0.0645	3,755	7.59
85	32,084	0.1168	3,748	5.43	54,465	0.0722	3,934	7.08
86	28,336	0.1275	3,613	5.08	50,531	0.0810	4,093	6.59
87	24,723	0.1392	3,442	4.75	46,438	0.0909	4,219	6.13
88	21,281	0.1520	3,235	4.44	42,219	0.1019	4,300	5.69
89	18,046	0.1659	2,994	4.15	37,919	0.1140	4,322	5.28
90	15,052	0.1808	2,721	3.87	33,597	0.1273	4,276	4.89
91	12,331	0.1966	2,424	3.61	29,321	0.1417	4,155	4.54
92	9,907	0.2133	2,113	3.38	25,166	0.1573	3,958	4.20
93	7,794	0.2307	1,798	3.16	21,208	0.1740	3,690	3.89
94	5,996	0.2487	1,491	2.95	17,518	0.1918	3,359	3.61
95	4,505	0.2672	1,204	2.76	14,159	0.2106	2,981	3.34
96	3,301	0.2862	945	2.59	11,178	0.2303	2,574	3.10
97	2,356	0.3059	721	2.43	8,604	0.2509	2,158	2.88
98	1,635	0.3263	533	2.28	6,446	0.2722	1,755	2.68
99	1,102	0.3472	383	2.14	4,691	0.2943	1,380	2.49
100	719	0.3687	265	2.01	3,311	0.3169	1,049	2.32
101	454	0.3905	177	1.89	2,262	0.3399	769	2.17
102	277	0.4127	114	1.78	1,493	0.3633	542	2.03
103	163	0.4351	71	1.68	951	0.3868	368	1.90
104	92	0.4576	42	1.58	583	0.4102	239	1.79
105	50	0.4800	24	1.50	344	0.4336	149	1.68
106	26	0.5022	13	1.42	195	0.4565	89	1.59
107	13	0.5241	7	1.35	106	0.4789	51	1.51
108	6	0.5455	3	1.28	55	0.5007	28	1.43
109	3	0.5661	2	1.23	27	0.5215	14	1.36
110	1	0.5859	1	1.17	13	0.5413	7	1.30
111	0	0.6047	0	1.13	6	0.5598	3	1.25
112	0	0.6223	0	1.08	3	0.5770	2	1.20
113	0	0.6384	0	1.05	1	0.5926	1	1.16
114	0	0.6530	0	1.02	0	0.6066	0	1.13
115	0	0.6659	0	0.99	0	0.6188	0	1.10
120	0	0.7000	0	0.80	0	0.6500	0	0.85

**Table 51 Beneficiaries by Age, Sex, Marital Status, and Type of Benefit (2009)**

Age	No GIS Married		No GIS Single		GIS Married		GIS Single	
	Males	Females	Males	Females	Males	Females	Males	Females
65	85,905	74,896	21,830	31,122	15,492	15,672	10,913	19,409
66	89,184	77,881	21,633	32,279	20,319	18,144	13,330	23,117
67	83,001	70,765	19,384	29,637	21,248	18,336	13,470	25,050
68	74,060	63,966	17,447	26,685	21,271	17,823	13,147	25,297
69	69,663	59,421	16,078	25,868	21,775	18,072	13,031	26,094
70	64,897	53,996	14,301	24,588	20,895	17,352	12,272	26,042
71	62,075	50,779	14,094	24,738	21,141	16,918	12,067	26,498
72	57,524	46,424	13,415	24,605	19,613	15,722	11,128	25,808
73	55,576	43,644	13,249	25,250	18,886	15,157	10,851	25,679
74	52,629	40,516	12,935	25,644	18,209	14,358	10,592	26,740
75	49,313	36,877	12,583	26,013	17,932	13,761	10,166	27,274
76	46,594	34,009	12,653	25,997	17,259	12,823	9,903	27,408
77	45,118	32,264	12,837	27,473	17,134	12,265	9,995	29,332
78	42,784	29,250	12,759	27,911	15,712	11,349	9,302	29,782
79	39,878	26,731	12,670	28,458	15,481	10,485	9,210	30,686
80	34,556	22,791	11,941	27,507	13,677	9,152	8,359	29,920
81	31,475	20,149	11,739	27,562	12,824	8,291	8,097	30,630
82	27,834	17,402	11,214	27,037	11,484	7,258	7,519	30,528
83	24,325	15,095	10,782	26,673	10,231	6,132	6,937	30,024
84	21,404	12,894	10,428	26,365	8,940	5,197	6,394	29,848
85	18,266	10,486	9,647	25,272	7,654	4,386	5,783	29,022
86	15,298	8,795	9,012	23,482	6,383	3,426	4,991	27,456
87	12,890	6,846	8,219	21,909	5,532	2,858	4,566	26,574
88	10,621	5,317	7,541	19,922	4,659	2,216	4,136	24,840
89	8,209	3,952	6,448	17,465	3,797	1,731	3,662	23,039
90	5,389	2,450	4,782	13,088	2,622	1,118	2,879	18,826
91	3,858	1,638	3,821	11,089	2,171	833	2,617	16,533
92	2,872	1,137	3,139	8,876	1,650	541	2,141	14,028
93	2,045	784	2,573	7,419	1,209	409	1,794	12,078
94	1,448	528	2,038	6,120	888	246	1,487	10,206
95	947	380	1,578	4,702	641	175	1,205	8,600
96	613	222	1,134	3,487	446	104	981	6,541
97	368	128	739	2,369	285	83	703	5,174
98	228	90	461	1,701	168	45	491	3,587
99	120	53	296	1,179	109	19	337	2,550
100+	117	46	460	1,863	132	15	605	4,799
<b>Total</b>	<b>1,141,084</b>	<b>872,602</b>	<b>345,860</b>	<b>711,355</b>	<b>377,869</b>	<b>282,472</b>	<b>245,061</b>	<b>779,019</b>



**Table 52 Exposures by Age, Sex, Marital Status, and Type of Benefit (2005-2009)**

Age	No GIS Married		No GIS Single		GIS Married		GIS Single	
	Males	Females	Males	Females	Males	Females	Males	Females
65	387,774	340,895	95,450	140,854	95,050	83,732	56,158	103,859
66	378,453	331,154	90,016	137,428	103,968	86,726	59,676	114,032
67	351,202	305,199	81,688	128,606	105,778	85,824	59,744	118,592
68	327,632	282,071	74,960	122,594	106,602	85,294	58,979	121,755
69	310,487	261,872	70,285	120,054	104,767	83,450	57,514	124,128
70	296,936	245,054	67,762	120,402	100,901	80,537	55,513	125,287
71	283,047	228,578	65,999	121,904	96,982	77,057	53,576	126,163
72	271,117	213,877	64,708	124,120	93,760	73,999	52,068	128,196
73	260,872	200,463	63,990	127,450	91,254	71,078	50,961	132,030
74	249,070	186,716	63,375	130,438	88,490	67,723	49,684	136,599
75	236,158	173,119	63,062	133,013	85,470	64,039	48,390	140,795
76	221,605	158,797	62,103	135,084	81,693	59,985	46,769	144,759
77	205,643	144,067	61,049	136,067	77,233	55,547	44,827	148,276
78	187,643	128,772	59,221	135,971	72,125	50,575	42,622	150,640
79	169,370	113,922	57,262	135,149	66,615	45,491	40,252	152,240
80	151,735	99,838	55,373	134,159	60,483	40,541	37,433	152,740
81	135,030	87,022	53,191	132,507	54,499	35,704	34,817	152,638
82	118,518	74,555	50,642	129,399	48,358	30,611	31,948	150,910
83	103,214	63,066	48,116	125,249	42,448	26,100	29,351	148,736
84	88,262	51,822	44,674	118,432	36,844	21,816	26,582	144,406
85	73,925	41,561	40,615	109,602	31,711	17,917	23,997	138,294
86	59,016	31,679	35,596	97,141	26,400	14,050	21,229	128,352
87	45,836	23,233	30,733	84,347	21,806	10,891	18,839	117,305
88	34,532	16,643	25,806	71,533	17,478	8,095	16,510	105,014
89	25,471	11,716	21,364	60,036	13,810	5,906	14,348	92,659
90	18,563	8,119	17,410	49,618	10,710	4,188	12,498	80,776
91	13,712	5,767	14,308	41,598	8,357	2,980	10,741	70,602
92	9,704	3,972	11,522	33,752	6,258	2,059	9,022	60,117
93	6,581	2,627	8,839	26,607	4,563	1,384	7,385	49,874
94	4,347	1,707	6,483	20,323	3,130	923	5,872	40,082
95	2,698	1,051	4,561	14,891	2,136	570	4,483	30,947
96	1,639	601	3,082	10,523	1,384	331	3,296	23,326
97	940	350	2,044	7,362	858	182	2,361	16,994
98	504	191	1,345	4,998	515	95	1,622	11,889
99	257	92	841	3,241	299	42	1,103	8,139
100	144	51	501	2,062	155	20	671	5,410
101	63	22	295	1,272	85	12	408	3,411
102	28	8	175	714	42	5	250	2,131
103	10	5	103	400	25	3	144	1,293
104	9	4	49	215	12	0	82	782
105	5	2	24	114	7	0	43	440
106	2	2	14	60	1	0	15	233
107	1	1	6	38	0	0	7	130
108	1	0	2	21	0	0	3	66
109	1	0	0	13	1	0	0	32
110+	1	0	1	13	0	0	4	27
Total	5,031,758	3,840,264	1,518,645	3,229,372	1,763,062	1,295,481	1,091,796	3,705,106

**Table 53 Mortality Rates by Age, Sex, Marital Status, and Type of Benefit (2007)**

Age	No GIS Married		No GIS Single		GIS Married		GIS Single	
	Males	Females	Males	Females	Males	Females	Males	Females
65	0.0099	0.0063	0.0183	0.0094	0.0150	0.0093	0.0325	0.0147
66	0.0110	0.0069	0.0195	0.0100	0.0166	0.0102	0.0346	0.0157
67	0.0121	0.0076	0.0209	0.0108	0.0183	0.0111	0.0368	0.0168
68	0.0134	0.0084	0.0227	0.0118	0.0201	0.0122	0.0391	0.0180
69	0.0149	0.0092	0.0246	0.0129	0.0219	0.0133	0.0416	0.0193
70	0.0165	0.0102	0.0269	0.0141	0.0239	0.0146	0.0442	0.0207
71	0.0184	0.0113	0.0295	0.0155	0.0261	0.0160	0.0470	0.0223
72	0.0205	0.0124	0.0324	0.0171	0.0286	0.0176	0.0501	0.0240
73	0.0229	0.0138	0.0356	0.0188	0.0313	0.0194	0.0535	0.0258
74	0.0257	0.0152	0.0392	0.0206	0.0343	0.0214	0.0572	0.0278
75	0.0288	0.0169	0.0432	0.0227	0.0377	0.0236	0.0612	0.0301
76	0.0322	0.0188	0.0475	0.0250	0.0415	0.0261	0.0654	0.0326
77	0.0362	0.0210	0.0523	0.0277	0.0456	0.0290	0.0700	0.0354
78	0.0406	0.0236	0.0575	0.0307	0.0503	0.0324	0.0750	0.0385
79	0.0456	0.0266	0.0633	0.0341	0.0554	0.0363	0.0803	0.0420
80	0.0513	0.0301	0.0696	0.0379	0.0611	0.0408	0.0862	0.0459
81	0.0577	0.0343	0.0765	0.0424	0.0674	0.0460	0.0925	0.0504
82	0.0650	0.0392	0.0842	0.0475	0.0746	0.0519	0.0995	0.0555
83	0.0731	0.0450	0.0927	0.0534	0.0827	0.0587	0.1071	0.0613
84	0.0822	0.0518	0.1020	0.0602	0.0917	0.0663	0.1154	0.0680
85	0.0922	0.0597	0.1121	0.0679	0.1019	0.0749	0.1246	0.0756
86	0.1033	0.0689	0.1232	0.0766	0.1132	0.0846	0.1347	0.0843
87	0.1155	0.0795	0.1352	0.0864	0.1257	0.0952	0.1458	0.0941
88	0.1288	0.0915	0.1483	0.0973	0.1392	0.1070	0.1579	0.1050
89	0.1432	0.1051	0.1624	0.1093	0.1537	0.1198	0.1712	0.1171
90	0.1588	0.1203	0.1775	0.1225	0.1690	0.1336	0.1855	0.1302
91	0.1754	0.1371	0.1935	0.1368	0.1850	0.1484	0.2008	0.1445
92	0.1931	0.1556	0.2102	0.1522	0.2015	0.1641	0.2170	0.1600
93	0.2118	0.1758	0.2276	0.1687	0.2185	0.1808	0.2341	0.1766
94	0.2315	0.1976	0.2455	0.1863	0.2358	0.1985	0.2518	0.1943
95	0.2522	0.2212	0.2639	0.2048	0.2534	0.2171	0.2702	0.2131
96	0.2738	0.2464	0.2826	0.2244	0.2713	0.2367	0.2891	0.2328
97	0.2962	0.2724	0.3020	0.2448	0.2900	0.2571	0.3087	0.2534
98	0.3192	0.2992	0.3221	0.2661	0.3096	0.2782	0.3289	0.2747
99	0.3427	0.3262	0.3429	0.2881	0.3298	0.2999	0.3497	0.2967
100	0.3667	0.3535	0.3642	0.3107	0.3507	0.3222	0.3710	0.3193
101	0.3909	0.3806	0.3859	0.3338	0.3723	0.3449	0.3927	0.3423
102	0.4152	0.4072	0.4081	0.3572	0.3943	0.3679	0.4147	0.3655
103	0.4395	0.4333	0.4305	0.3809	0.4168	0.3910	0.4370	0.3889
104	0.4636	0.4584	0.4530	0.4046	0.4395	0.4141	0.4593	0.4122
105	0.4874	0.4824	0.4755	0.4282	0.4624	0.4370	0.4815	0.4354
106	0.5106	0.5051	0.4979	0.4515	0.4853	0.4595	0.5036	0.4582
107	0.5331	0.5264	0.5200	0.4743	0.5081	0.4815	0.5253	0.4805
108	0.5548	0.5460	0.5416	0.4965	0.5305	0.5029	0.5465	0.5021
109	0.5755	0.5639	0.5626	0.5177	0.5525	0.5234	0.5670	0.5227
110	0.5950	0.5801	0.5828	0.5380	0.5736	0.5428	0.5866	0.5423
120	0.7000	0.6500	0.7000	0.6500	0.7000	0.6500	0.7000	0.6500

**Table 54 Mortality Ratios by Age, Sex, Marital Status, and Type of Benefit (2007)\***

Age	No GIS Married		No GIS Single		GIS Married		GIS Single	
	Males	Females	Males	Females	Males	Females	Males	Females
65	0.71	0.72	1.31	1.09	1.07	1.08	2.32	1.70
66	0.71	0.73	1.26	1.05	1.08	1.07	2.25	1.65
67	0.72	0.73	1.23	1.03	1.08	1.07	2.17	1.61
68	0.72	0.73	1.22	1.02	1.08	1.06	2.11	1.57
69	0.73	0.73	1.21	1.02	1.08	1.05	2.05	1.52
70	0.74	0.73	1.21	1.01	1.07	1.05	1.98	1.48
71	0.75	0.73	1.20	1.01	1.07	1.04	1.92	1.45
72	0.76	0.73	1.20	1.00	1.06	1.04	1.86	1.41
73	0.77	0.73	1.20	1.00	1.05	1.04	1.80	1.38
74	0.78	0.73	1.19	0.99	1.05	1.03	1.74	1.35
75	0.79	0.74	1.19	0.99	1.04	1.03	1.68	1.31
76	0.80	0.74	1.18	0.98	1.03	1.03	1.63	1.28
77	0.81	0.74	1.17	0.98	1.02	1.03	1.57	1.25
78	0.82	0.75	1.16	0.97	1.02	1.03	1.52	1.22
79	0.83	0.76	1.15	0.97	1.01	1.03	1.47	1.20
80	0.84	0.77	1.14	0.97	1.00	1.04	1.42	1.17
81	0.85	0.78	1.13	0.96	1.00	1.04	1.37	1.15
82	0.86	0.79	1.12	0.96	0.99	1.05	1.32	1.12
83	0.87	0.81	1.11	0.96	0.99	1.05	1.28	1.10
84	0.88	0.83	1.09	0.96	0.99	1.06	1.24	1.08
85	0.89	0.84	1.08	0.96	0.98	1.06	1.20	1.07
86	0.90	0.86	1.07	0.96	0.98	1.06	1.17	1.06
87	0.91	0.88	1.06	0.96	0.98	1.06	1.14	1.05
88	0.91	0.90	1.05	0.96	0.99	1.06	1.12	1.04
89	0.92	0.92	1.04	0.96	0.98	1.05	1.10	1.03
90	0.92	0.94	1.03	0.96	0.98	1.05	1.08	1.02
91	0.93	0.97	1.03	0.97	0.98	1.05	1.07	1.02
92	0.94	0.99	1.02	0.97	0.98	1.04	1.05	1.02
93	0.94	1.01	1.01	0.97	0.97	1.04	1.04	1.01
94	0.95	1.03	1.01	0.97	0.97	1.03	1.04	1.01
95	0.96	1.06	1.01	0.97	0.97	1.03	1.03	1.01
96	0.97	1.08	1.00	0.97	0.96	1.03	1.03	1.01
97	0.98	1.10	1.00	0.98	0.96	1.02	1.02	1.01
98	0.98	1.11	0.99	0.98	0.96	1.02	1.02	1.01
99	0.99	1.12	0.99	0.98	0.96	1.02	1.01	1.01
100	1.00	1.13	0.99	0.98	0.96	1.02	1.01	1.01
101	1.01	1.13	0.99	0.98	0.96	1.01	1.01	1.01
102	1.01	1.13	0.99	0.98	0.96	1.01	1.01	1.01
103	1.02	1.13	0.99	0.98	0.96	1.01	1.00	1.01
104	1.02	1.13	0.99	0.99	0.96	1.01	1.00	1.01
105	1.02	1.12	1.00	0.99	0.96	1.01	1.00	1.00
106	1.02	1.12	1.00	0.99	0.96	1.01	1.00	1.00
107	1.02	1.11	1.00	0.99	0.97	1.01	1.00	1.00
108	1.02	1.10	1.00	0.99	0.97	1.00	1.00	1.00
109	1.02	1.09	1.00	0.99	0.97	1.00	1.00	1.00
110	1.02	1.08	1.00	1.00	0.98	1.00	1.00	1.00
120	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

\* Mortality ratios are ratios of mortality rates to overall OAS levels.

**Table 55 Life Table of Married Beneficiaries without GIS (2007)**

Age	Males				Females			
	$l_x$	$q_x$	$d_x$	$^o e_x$	$l_x$	$q_x$	$d_x$	$^o e_x$
65	100,000	0.0099	994	19.30	100,000	0.0063	626	22.45
66	99,006	0.0110	1,087	18.49	99,374	0.0069	685	21.59
67	97,919	0.0121	1,188	17.69	98,689	0.0076	749	20.74
68	96,731	0.0134	1,299	16.90	97,940	0.0084	819	19.89
69	95,432	0.0149	1,419	16.12	97,121	0.0092	895	19.06
70	94,013	0.0165	1,551	15.36	96,226	0.0102	980	18.23
71	92,462	0.0184	1,698	14.61	95,246	0.0113	1,072	17.41
72	90,764	0.0205	1,861	13.87	94,174	0.0124	1,172	16.60
73	88,903	0.0229	2,040	13.15	93,002	0.0138	1,280	15.81
74	86,863	0.0257	2,232	12.45	91,722	0.0152	1,398	15.02
75	84,631	0.0288	2,435	11.76	90,324	0.0169	1,527	14.24
76	82,196	0.0322	2,650	11.10	88,797	0.0188	1,672	13.48
77	79,546	0.0362	2,876	10.45	87,125	0.0210	1,833	12.73
78	76,670	0.0406	3,112	9.82	85,292	0.0236	2,014	11.99
79	73,558	0.0456	3,354	9.22	83,278	0.0266	2,217	11.27
80	70,204	0.0513	3,601	8.63	81,061	0.0301	2,443	10.56
81	66,603	0.0577	3,845	8.07	78,618	0.0343	2,697	9.88
82	62,758	0.0650	4,078	7.54	75,921	0.0392	2,976	9.21
83	58,680	0.0731	4,290	7.03	72,945	0.0450	3,281	8.57
84	54,390	0.0822	4,469	6.54	69,664	0.0518	3,607	7.95
85	49,921	0.0922	4,604	6.08	66,057	0.0597	3,944	7.35
86	45,317	0.1033	4,683	5.65	62,113	0.0689	4,279	6.79
87	40,634	0.1155	4,694	5.24	57,834	0.0795	4,595	6.25
88	35,940	0.1288	4,630	4.86	53,239	0.0915	4,871	5.75
89	31,310	0.1432	4,485	4.51	48,368	0.1051	5,082	5.28
90	26,825	0.1588	4,260	4.18	43,286	0.1203	5,206	4.84
91	22,565	0.1754	3,959	3.87	38,080	0.1371	5,221	4.43
92	18,606	0.1931	3,593	3.59	32,859	0.1556	5,113	4.06
93	15,013	0.2118	3,180	3.32	27,746	0.1758	4,878	3.71
94	11,833	0.2315	2,740	3.08	22,868	0.1976	4,520	3.40
95	9,093	0.2522	2,293	2.86	18,348	0.2212	4,058	3.11
96	6,800	0.2738	1,862	2.66	14,290	0.2464	3,521	2.85
97	4,938	0.2962	1,463	2.47	10,769	0.2724	2,934	2.62
98	3,475	0.3192	1,109	2.30	7,835	0.2992	2,344	2.41
99	2,366	0.3427	811	2.15	5,491	0.3262	1,791	2.23
100	1,555	0.3667	570	2.00	3,700	0.3535	1,308	2.06
101	985	0.3909	385	1.88	2,392	0.3806	910	1.92
102	600	0.4152	249	1.76	1,482	0.4072	604	1.79
103	351	0.4395	154	1.65	878	0.4333	380	1.68
104	197	0.4636	91	1.56	498	0.4584	228	1.58
105	106	0.4874	52	1.47	270	0.4824	130	1.49
106	54	0.5106	28	1.39	140	0.5051	71	1.41
107	26	0.5331	14	1.32	69	0.5264	36	1.35
108	12	0.5548	7	1.26	33	0.5460	18	1.29
109	5	0.5755	3	1.20	15	0.5639	8	1.24
110	2	0.5950	1	1.15	7	0.5801	4	1.20
111	1	0.6132	1	1.11	3	0.5944	2	1.16
112	0	0.6299	0	1.07	1	0.6070	1	1.13
113	0	0.6451	0	1.03	0	0.6177	0	1.11
114	0	0.6586	0	1.01	0	0.6267	0	1.09
115	0	0.6703	0	0.98	0	0.6341	0	1.07
120	0	0.7000	0	0.80	0	0.6500	0	0.85



**Table 56 Life Table of Married Beneficiaries with GIS (2007)**

Age	Males				Females			
	$l_x$	$q_x$	$d_x$	$e_x$	$l_x$	$q_x$	$d_x$	$e_x$
65	100,000	0.0150	1,496	17.63	100,000	0.0093	933	20.69
66	98,504	0.0166	1,637	16.89	99,067	0.0102	1,009	19.88
67	96,867	0.0183	1,775	16.17	98,058	0.0111	1,092	19.07
68	95,092	0.0201	1,911	15.46	96,966	0.0122	1,181	18.28
69	93,181	0.0220	2,046	14.77	95,785	0.0133	1,277	17.50
70	91,135	0.0239	2,182	14.09	94,508	0.0146	1,380	16.73
71	88,953	0.0261	2,324	13.42	93,128	0.0160	1,494	15.97
72	86,629	0.0286	2,474	12.77	91,634	0.0176	1,616	15.23
73	84,155	0.0313	2,632	12.13	90,018	0.0194	1,748	14.49
74	81,523	0.0343	2,799	11.51	88,270	0.0214	1,888	13.77
75	78,724	0.0377	2,969	10.90	86,382	0.0236	2,039	13.06
76	75,755	0.0415	3,142	10.30	84,343	0.0261	2,204	12.36
77	72,613	0.0457	3,315	9.73	82,139	0.0290	2,385	11.68
78	69,298	0.0503	3,484	9.17	79,754	0.0324	2,583	11.01
79	65,814	0.0554	3,647	8.63	77,171	0.0363	2,801	10.37
80	62,167	0.0611	3,800	8.11	74,370	0.0408	3,036	9.74
81	58,367	0.0675	3,941	7.60	71,334	0.0460	3,283	9.13
82	54,426	0.0747	4,064	7.11	68,051	0.0520	3,538	8.55
83	50,362	0.0827	4,164	6.65	64,513	0.0588	3,791	7.99
84	46,198	0.0916	4,233	6.20	60,722	0.0664	4,033	7.45
85	41,965	0.1016	4,265	5.78	56,689	0.0750	4,250	6.95
86	37,700	0.1128	4,252	5.38	52,439	0.0844	4,428	6.47
87	33,448	0.1251	4,186	4.99	48,011	0.0948	4,553	6.02
88	29,262	0.1387	4,059	4.64	43,458	0.1061	4,613	5.60
89	25,203	0.1535	3,868	4.30	38,845	0.1184	4,598	5.21
90	21,335	0.1694	3,615	3.99	34,247	0.1315	4,502	4.84
91	17,720	0.1864	3,303	3.71	29,745	0.1455	4,329	4.50
92	14,417	0.2043	2,945	3.44	25,416	0.1606	4,082	4.18
93	11,472	0.2232	2,560	3.20	21,334	0.1767	3,769	3.88
94	8,912	0.2429	2,165	2.97	17,565	0.1937	3,402	3.61
95	6,747	0.2635	1,778	2.76	14,163	0.2116	2,997	3.35
96	4,969	0.2848	1,415	2.57	11,166	0.2305	2,574	3.12
97	3,554	0.3068	1,090	2.40	8,592	0.2502	2,150	2.90
98	2,464	0.3294	812	2.24	6,442	0.2707	1,744	2.70
99	1,652	0.3524	582	2.09	4,698	0.2919	1,371	2.52
100	1,070	0.3758	402	1.96	3,327	0.3137	1,044	2.35
101	668	0.3994	267	1.84	2,283	0.3361	767	2.20
102	401	0.4231	170	1.73	1,516	0.3588	544	2.06
103	231	0.4467	103	1.63	972	0.3818	371	1.93
104	128	0.4701	60	1.53	601	0.4049	243	1.81
105	68	0.4932	34	1.45	358	0.4279	153	1.71
106	34	0.5157	18	1.38	205	0.4507	92	1.61
107	16	0.5376	9	1.31	113	0.4731	53	1.53
108	7	0.5587	4	1.25	60	0.4949	30	1.45
109	3	0.5787	2	1.19	30	0.5160	15	1.38
110	1	0.5977	1	1.14	15	0.5362	8	1.32
111	0	0.6153	0	1.10	7	0.5552	4	1.26
112	0	0.6316	0	1.06	3	0.5729	2	1.21
113	0	0.6464	0	1.03	1	0.5892	1	1.17
114	0	0.6595	0	1.00	0	0.6038	0	1.14
115	0	0.6709	0	0.98	0	0.6166	0	1.11
120	0	0.7000	0	0.80	0	0.6500	0	0.85

**Table 57 Life Table of Single Beneficiaries without GIS (2007)**

Age	Males				Females			
	$l_x$	$q_x$	$d_x$	$e_x$	$l_x$	$q_x$	$d_x$	$e_x$
65	100,000	0.0183	1,832	16.73	100,000	0.0094	941	21.13
66	98,168	0.0195	1,914	16.04	99,059	0.0100	994	20.33
67	96,254	0.0209	2,016	15.34	98,065	0.0108	1,062	19.53
68	94,238	0.0227	2,135	14.66	97,003	0.0118	1,143	18.74
69	92,103	0.0246	2,269	13.99	95,860	0.0129	1,236	17.96
70	89,834	0.0269	2,417	13.33	94,624	0.0141	1,339	17.18
71	87,417	0.0295	2,578	12.69	93,285	0.0155	1,450	16.42
72	84,839	0.0324	2,749	12.06	91,835	0.0171	1,568	15.68
73	82,090	0.0356	2,925	11.44	90,267	0.0188	1,693	14.94
74	79,165	0.0392	3,104	10.85	88,574	0.0206	1,825	14.21
75	76,061	0.0432	3,282	10.27	86,749	0.0227	1,967	13.50
76	72,779	0.0475	3,458	9.71	84,782	0.0250	2,121	12.81
77	69,321	0.0523	3,624	9.17	82,661	0.0277	2,286	12.12
78	65,697	0.0575	3,779	8.65	80,375	0.0307	2,464	11.45
79	61,918	0.0633	3,916	8.14	77,911	0.0341	2,653	10.80
80	58,002	0.0696	4,035	7.66	75,258	0.0379	2,855	10.16
81	53,967	0.0765	4,130	7.20	72,403	0.0424	3,068	9.54
82	49,837	0.0842	4,196	6.75	69,335	0.0475	3,293	8.94
83	45,641	0.0927	4,229	6.33	66,042	0.0534	3,527	8.36
84	41,412	0.1020	4,222	5.92	62,515	0.0602	3,762	7.81
85	37,190	0.1121	4,170	5.54	58,753	0.0679	3,989	7.27
86	33,020	0.1232	4,067	5.17	54,764	0.0766	4,195	6.77
87	28,953	0.1352	3,915	4.83	50,569	0.0864	4,369	6.29
88	25,038	0.1483	3,713	4.51	46,200	0.0973	4,495	5.83
89	21,325	0.1624	3,464	4.20	41,705	0.1093	4,559	5.41
90	17,861	0.1775	3,171	3.92	37,146	0.1225	4,551	5.01
91	14,690	0.1935	2,843	3.66	32,595	0.1368	4,460	4.64
92	11,847	0.2102	2,491	3.42	28,135	0.1522	4,283	4.30
93	9,356	0.2276	2,130	3.19	23,852	0.1687	4,025	3.98
94	7,226	0.2455	1,774	2.99	19,827	0.1863	3,693	3.69
95	5,452	0.2639	1,439	2.80	16,134	0.2048	3,305	3.42
96	4,013	0.2826	1,134	2.62	12,829	0.2244	2,878	3.17
97	2,879	0.3020	869	2.46	9,951	0.2448	2,436	2.94
98	2,010	0.3221	647	2.31	7,515	0.2661	1,999	2.73
99	1,363	0.3429	467	2.17	5,516	0.2881	1,589	2.54
100	896	0.3642	326	2.03	3,927	0.3107	1,220	2.37
101	570	0.3859	220	1.91	2,707	0.3338	904	2.21
102	350	0.4081	143	1.80	1,803	0.3572	644	2.06
103	207	0.4305	89	1.70	1,159	0.3809	441	1.93
104	118	0.4530	53	1.60	718	0.4046	291	1.81
105	65	0.4755	31	1.51	427	0.4282	183	1.71
106	34	0.4979	17	1.43	244	0.4515	110	1.61
107	17	0.5200	9	1.36	134	0.4743	64	1.52
108	8	0.5416	4	1.30	70	0.4965	35	1.44
109	4	0.5626	2	1.24	35	0.5177	18	1.37
110	2	0.5828	1	1.18	17	0.5380	9	1.31
111	1	0.6019	1	1.13	8	0.5570	4	1.26
112	0	0.6199	0	1.09	4	0.5746	2	1.21
113	0	0.6365	0	1.05	2	0.5907	1	1.17
114	0	0.6515	0	1.02	1	0.6051	1	1.13
115	0	0.6648	0	0.99	0	0.6177	0	1.10
120	0	0.7000	0	0.80	0	0.6500	0	0.85

**Table 58 Life Table of Single Beneficiaries with GIS (2007)**

Age	Males				Females			
	$l_x$	$q_x$	$d_x$	$e_x$	$l_x$	$q_x$	$d_x$	$e_x$
65	100,000	0.0325	3,254	14.10	100,000	0.0147	1,468	19.39
66	96,746	0.0346	3,348	13.56	98,532	0.0157	1,545	18.67
67	93,398	0.0368	3,437	13.03	96,987	0.0168	1,628	17.96
68	89,961	0.0391	3,521	12.50	95,359	0.0180	1,716	17.26
69	86,440	0.0416	3,597	11.99	93,643	0.0193	1,808	16.57
70	82,843	0.0442	3,665	11.49	91,835	0.0207	1,904	15.89
71	79,178	0.0470	3,725	11.00	89,931	0.0223	2,003	15.21
72	75,453	0.0501	3,781	10.52	87,928	0.0240	2,106	14.55
73	71,672	0.0535	3,833	10.05	85,822	0.0258	2,214	13.89
74	67,839	0.0572	3,878	9.59	83,608	0.0278	2,328	13.25
75	63,961	0.0612	3,911	9.14	81,280	0.0301	2,447	12.61
76	60,050	0.0654	3,929	8.70	78,833	0.0326	2,572	11.99
77	56,121	0.0700	3,929	8.28	76,261	0.0354	2,700	11.37
78	52,192	0.0750	3,913	7.86	73,561	0.0385	2,833	10.77
79	48,279	0.0803	3,879	7.46	70,728	0.0420	2,970	10.18
80	44,400	0.0862	3,826	7.07	67,758	0.0459	3,113	9.61
81	40,574	0.0926	3,755	6.69	64,645	0.0504	3,260	9.05
82	36,819	0.0995	3,665	6.32	61,385	0.0555	3,408	8.50
83	33,154	0.1072	3,553	5.96	57,977	0.0613	3,556	7.97
84	29,601	0.1155	3,419	5.61	54,421	0.0680	3,700	7.46
85	26,182	0.1247	3,264	5.28	50,721	0.0756	3,835	6.97
86	22,918	0.1347	3,087	4.96	46,886	0.0843	3,952	6.50
87	19,831	0.1457	2,889	4.66	42,934	0.0941	4,040	6.05
88	16,942	0.1577	2,672	4.37	38,894	0.1051	4,086	5.63
89	14,270	0.1708	2,437	4.09	34,808	0.1172	4,078	5.23
90	11,833	0.1849	2,188	3.83	30,730	0.1304	4,006	4.85
91	9,645	0.1999	1,928	3.59	26,724	0.1446	3,863	4.51
92	7,717	0.2157	1,664	3.36	22,861	0.1598	3,653	4.18
93	6,053	0.2323	1,406	3.14	19,208	0.1760	3,380	3.88
94	4,647	0.2497	1,160	2.95	15,828	0.1931	3,057	3.61
95	3,487	0.2679	934	2.76	12,771	0.2113	2,698	3.35
96	2,553	0.2868	732	2.59	10,073	0.2303	2,320	3.12
97	1,821	0.3065	558	2.42	7,753	0.2502	1,940	2.90
98	1,263	0.3268	413	2.27	5,813	0.2709	1,575	2.70
99	850	0.3476	295	2.14	4,238	0.2923	1,239	2.51
100	555	0.3690	205	2.01	2,999	0.3143	943	2.35
101	350	0.3908	137	1.89	2,056	0.3368	692	2.19
102	213	0.4130	88	1.78	1,364	0.3596	491	2.05
103	125	0.4353	54	1.68	873	0.3827	334	1.93
104	71	0.4578	33	1.58	539	0.4059	219	1.81
105	38	0.4801	18	1.50	320	0.4290	137	1.70
106	20	0.5023	10	1.42	183	0.4518	83	1.61
107	10	0.5242	5	1.35	100	0.4742	47	1.52
108	5	0.5455	3	1.28	53	0.4961	26	1.45
109	2	0.5661	1	1.23	27	0.5171	14	1.38
110	1	0.5859	1	1.17	13	0.5372	7	1.31
111	0	0.6047	0	1.13	6	0.5561	3	1.26
112	0	0.6222	0	1.09	3	0.5737	2	1.21
113	0	0.6384	0	1.05	1	0.5899	1	1.17
114	0	0.6530	0	1.02	0	0.6043	0	1.13
115	0	0.6659	0	0.99	0	0.6170	0	1.10
120	0	0.7000	0	0.80	0	0.6500	0	0.85

**Table 59 Deaths by Receipt of a CPP Retirement Pension  
 (Canada less Québec, 2005-2009)**

Age	Canada less Québec with CPP Retirement Pension		Canada less Québec without CPP Retirement Pension		Canada less Québec	
	Males	Females	Males	Females	Males	Females
65	6,020	3,621	493	701	6,513	4,322
66	6,930	4,044	266	722	7,196	4,765
67	7,243	4,167	237	754	7,480	4,921
68	7,711	4,452	270	820	7,981	5,272
69	8,005	4,652	267	893	8,271	5,545
70	8,536	4,922	283	1,100	8,819	6,021
71	8,832	5,345	278	1,125	9,110	6,470
72	9,493	5,524	268	1,389	9,761	6,913
73	10,236	5,966	371	1,495	10,606	7,461
74	10,984	6,432	421	1,776	11,404	8,208
75	11,648	6,736	468	1,959	12,116	8,695
76	12,026	7,261	546	2,309	12,572	9,570
77	12,799	7,621	601	2,674	13,399	10,295
78	13,385	7,993	627	3,034	14,011	11,027
79	13,510	8,553	676	3,342	14,185	11,895
80	13,772	9,060	705	3,843	14,477	12,903
81	13,935	9,326	758	4,360	14,693	13,685
82	14,260	9,892	752	4,918	15,012	14,810
83	14,181	10,237	876	5,273	15,056	15,510
84	14,017	10,687	818	5,822	14,835	16,508
85	13,482	10,901	889	6,293	14,371	17,194
86	12,614	10,540	882	6,429	13,496	16,969
87	11,575	10,284	918	6,784	12,492	17,068
88	10,300	9,330	810	6,848	11,110	16,178
89	9,214	8,962	760	6,787	9,974	15,749
90	8,119	8,014	696	6,619	8,815	14,633
91	7,292	7,468	657	6,709	7,949	14,177
92	6,141	6,674	593	6,403	6,734	13,077
93	5,153	5,800	538	5,946	5,691	11,786
94	3,982	4,779	456	5,382	4,438	10,161
95	2,950	3,944	356	4,692	3,305	8,636
96	2,192	3,090	309	3,886	2,501	6,976
97	1,590	2,293	240	3,225	1,799	5,538
98	1,037	1,722	181	2,643	1,218	4,365
99	726	1,178	132	1,838	852	3,056
100	496	783	84	1,406	579	2,109
101	280	522	50	1,044	330	1,365
102	142	304	42	679	184	983
103	80	195	29	486	115	641
104	52	94	18	330	69	391
105	33	52	17	215	50	240
106	17	30	6	96	23	126
107	8	10	4	50	8	60
108	3	6	3	47	3	48
109	2	3	1	24	2	23
110+	1	1	1	17	1	18
Total	219,498	122,889	28,423	122,127	247,921	135,016



**Table 60 Exposures by Receipt of a CPP Retirement Pension  
 (Canada less Québec, 2005-2009)**

Age	Canada less Québec with CPP Retirement Pension		Canada less Québec without CPP Retirement Pension		Canada less Québec	
	Males	Females	Males	Females	Males	Females
65	444,377	437,748	22,163	52,738	466,540	490,486
66	454,377	443,121	12,478	49,056	466,855	492,177
67	433,075	419,822	11,128	50,945	444,203	470,767
68	413,327	399,295	10,751	53,461	424,079	452,757
69	396,989	381,187	10,464	56,279	407,453	437,466
70	382,016	365,661	10,223	58,748	392,239	424,409
71	366,506	349,572	10,655	61,720	377,160	411,291
72	352,521	335,689	11,203	64,961	363,724	400,650
73	340,685	324,104	11,719	68,636	352,405	392,739
74	328,118	312,420	12,091	72,575	340,208	384,996
75	314,699	300,395	12,443	76,364	327,142	376,759
76	299,131	287,598	12,585	80,011	311,716	367,609
77	282,245	273,827	12,598	83,078	294,843	356,905
78	262,743	259,076	12,492	85,501	275,235	344,577
79	242,036	243,759	12,242	87,591	254,277	331,350
80	221,450	228,818	11,835	89,021	233,285	317,839
81	201,517	214,548	11,360	89,884	212,877	304,432
82	181,338	199,299	10,842	89,678	192,181	288,977
83	162,368	184,226	10,285	89,136	172,653	273,363
84	143,194	167,545	9,690	86,799	152,884	254,344
85	124,482	149,917	9,017	83,608	133,499	233,525
86	104,004	129,023	7,975	77,200	111,979	206,223
87	85,519	108,906	6,941	70,109	92,460	179,015
88	68,892	90,113	5,929	62,753	74,821	152,866
89	54,658	73,727	4,983	55,527	59,641	129,255
90	42,959	59,537	4,220	48,752	47,179	108,289
91	34,206	48,840	3,548	43,312	37,753	92,152
92	26,425	39,038	2,936	37,364	29,381	76,401
93	19,562	30,385	2,420	31,201	21,982	61,586
94	14,024	22,959	1,908	25,326	15,932	48,285
95	9,695	16,649	1,430	19,740	11,125	36,389
96	6,488	11,613	1,053	14,964	7,541	26,576
97	4,239	7,929	724	11,025	4,963	18,954
98	2,724	5,272	482	7,821	3,206	13,093
99	1,709	3,354	336	5,425	2,045	8,779
100	1,096	2,099	206	3,703	1,212	5,762
101	554	1,187	139	2,441	693	3,629
102	312	665	98	1,564	409	2,208
103	172	396	63	964	234	1,322
104	86	209	42	608	129	785
105	47	115	27	357	69	432
106	25	61	11	200	36	230
107	9	28	7	119	17	114
108	3	9	3	69	6	76
109	0	2	1	37	2	38
110	0	1	0	21	0	20
Total	4,479,449	4,479,449	200,767	1,496,112	4,680,216	5,975,561

**Table 61 Mortality Rates by Receipt of a CPP Retirement Pension  
 (Canada less Québec, 2007)**

Age	Canada less Québec with CPP Retirement Pension		Canada less Québec without CPP Retirement Pension		Canada less Québec	
	Males	Females	Males	Females	Males	Females
65	0.0136	0.0083	0.0237	0.0136	0.0140	0.0088
66	0.0151	0.0091	0.0230	0.0141	0.0153	0.0096
67	0.0166	0.0100	0.0227	0.0147	0.0168	0.0105
68	0.0182	0.0110	0.0229	0.0155	0.0184	0.0115
69	0.0200	0.0122	0.0236	0.0164	0.0201	0.0127
70	0.0220	0.0135	0.0246	0.0175	0.0221	0.0140
71	0.0242	0.0149	0.0260	0.0187	0.0243	0.0155
72	0.0267	0.0165	0.0280	0.0202	0.0267	0.0171
73	0.0295	0.0183	0.0305	0.0218	0.0295	0.0189
74	0.0326	0.0202	0.0336	0.0237	0.0327	0.0209
75	0.0361	0.0224	0.0371	0.0259	0.0362	0.0231
76	0.0400	0.0248	0.0409	0.0284	0.0400	0.0256
77	0.0443	0.0275	0.0448	0.0312	0.0443	0.0284
78	0.0492	0.0307	0.0489	0.0344	0.0492	0.0316
79	0.0546	0.0342	0.0533	0.0381	0.0545	0.0353
80	0.0606	0.0383	0.0582	0.0422	0.0605	0.0394
81	0.0674	0.0430	0.0636	0.0468	0.0672	0.0441
82	0.0750	0.0484	0.0699	0.0521	0.0747	0.0496
83	0.0835	0.0547	0.0772	0.0581	0.0831	0.0558
84	0.0929	0.0618	0.0856	0.0649	0.0924	0.0629
85	0.1033	0.0700	0.0951	0.0727	0.1028	0.0709
86	0.1149	0.0792	0.1055	0.0815	0.1142	0.0800
87	0.1276	0.0895	0.1167	0.0914	0.1268	0.0902
88	0.1416	0.1009	0.1285	0.1025	0.1405	0.1015
89	0.1567	0.1134	0.1410	0.1146	0.1554	0.1139
90	0.1730	0.1271	0.1542	0.1279	0.1713	0.1275
91	0.1902	0.1419	0.1682	0.1423	0.1882	0.1422
92	0.2083	0.1577	0.1832	0.1580	0.2058	0.1580
93	0.2271	0.1747	0.1991	0.1749	0.2241	0.1750
94	0.2463	0.1927	0.2159	0.1930	0.2429	0.1931
95	0.2661	0.2116	0.2336	0.2122	0.2621	0.2121
96	0.2861	0.2316	0.2518	0.2324	0.2816	0.2320
97	0.3068	0.2523	0.2709	0.2535	0.3018	0.2528
98	0.3282	0.2739	0.2909	0.2753	0.3227	0.2743
99	0.3501	0.2961	0.3117	0.2978	0.3441	0.2965
100	0.3724	0.3188	0.3333	0.3208	0.3661	0.3192
101	0.3950	0.3420	0.3555	0.3441	0.3884	0.3424
102	0.4179	0.3654	0.3784	0.3677	0.4111	0.3658
103	0.4409	0.3890	0.4018	0.3914	0.4340	0.3893
104	0.4637	0.4125	0.4255	0.4150	0.4568	0.4128
105	0.4863	0.4358	0.4495	0.4384	0.4796	0.4361
106	0.5087	0.4597	0.4735	0.4623	0.5022	0.4590
107	0.5309	0.4833	0.4974	0.4856	0.5243	0.4813
108	0.5527	0.5067	0.5210	0.5091	0.5458	0.5029
109	0.5743	0.5298	0.5443	0.5326	0.5667	0.5256
110	0.5956	0.5528	0.5674	0.5554	0.5869	0.5471
111	0.6166	0.5756	0.5903	0.5780	0.6064	0.5680

**Table 62 Mortality Ratios by Receipt of a CPP Retirement Pension  
 (Canada less Québec, 2007)\***

Age	Canada less Québec with CPP Retirement Pension		Canada less Québec without CPP Retirement Pension		Canada less Québec	
	Males	Females	Males	Females	Males	Females
65	0.97	0.96	1.69	1.58	1.00	1.02
66	0.98	0.95	1.49	1.49	0.99	1.01
67	0.98	0.96	1.34	1.41	0.99	1.01
68	0.98	0.96	1.23	1.35	0.99	1.00
69	0.99	0.96	1.16	1.29	0.99	1.00
70	0.99	0.97	1.10	1.25	0.99	1.01
71	0.99	0.97	1.06	1.22	0.99	1.01
72	0.99	0.97	1.04	1.19	0.99	1.01
73	0.99	0.97	1.03	1.17	0.99	1.01
74	0.99	0.98	1.02	1.15	0.99	1.01
75	0.99	0.98	1.02	1.13	1.00	1.01
76	0.99	0.98	1.02	1.12	1.00	1.01
77	0.99	0.97	1.01	1.10	0.99	1.01
78	0.99	0.97	0.99	1.09	0.99	1.00
79	1.00	0.97	0.97	1.08	0.99	1.00
80	1.00	0.98	0.96	1.07	0.99	1.00
81	1.00	0.98	0.94	1.06	0.99	1.00
82	1.00	0.98	0.93	1.05	0.99	1.00
83	1.00	0.98	0.92	1.04	0.99	1.00
84	1.00	0.99	0.92	1.04	0.99	1.00
85	1.00	0.99	0.92	1.03	0.99	1.00
86	1.00	0.99	0.92	1.02	0.99	1.00
87	1.00	0.99	0.91	1.02	0.99	1.00
88	1.00	1.00	0.91	1.01	0.99	1.00
89	1.00	1.00	0.90	1.01	1.00	1.00
90	1.01	1.00	0.90	1.01	1.00	1.00
91	1.01	1.00	0.89	1.00	1.00	1.00
92	1.01	1.00	0.89	1.00	1.00	1.00
93	1.01	1.00	0.89	1.00	1.00	1.00
94	1.01	1.00	0.89	1.00	1.00	1.01
95	1.02	1.00	0.89	1.01	1.00	1.01
96	1.02	1.00	0.89	1.01	1.00	1.01
97	1.02	1.01	0.90	1.01	1.00	1.01
98	1.02	1.01	0.90	1.01	1.00	1.01
99	1.01	1.01	0.90	1.01	1.00	1.01
100	1.01	1.01	0.91	1.01	1.00	1.01
101	1.01	1.01	0.91	1.01	1.00	1.01
102	1.01	1.01	0.92	1.01	1.00	1.01
103	1.01	1.01	0.92	1.01	1.00	1.01
104	1.01	1.01	0.93	1.01	1.00	1.01
105	1.01	1.01	0.93	1.01	1.00	1.01
106	1.01	1.01	0.94	1.01	1.00	1.01
107	1.01	1.01	0.95	1.01	1.00	1.01
108	1.01	1.00	0.95	1.01	1.00	1.00
109	1.01	1.00	0.96	1.01	1.00	1.00
110	1.01	1.00	0.96	1.01	1.00	1.00
119	1.00	1.00	1.00	1.00	1.00	1.00

\* Mortality ratios are ratio of mortality rates to overall OAS levels.

**Table 63 Life Table of Canada less Québec Beneficiaries (2007)**

Age	Males				Females			
	$l_x$	$q_x$	$d_x$	${}^o e_x$	$l_x$	$q_x$	$d_x$	${}^o e_x$
65	100,000	0.0140	1,397	17.88	100,000	0.0088	881	20.96
66	98,603	0.0153	1,509	17.12	99,119	0.0096	950	20.14
67	97,094	0.0168	1,628	16.38	98,169	0.0105	1,030	19.33
68	95,466	0.0184	1,753	15.65	97,139	0.0115	1,121	18.53
69	93,713	0.0201	1,886	14.94	96,018	0.0127	1,222	17.74
70	91,827	0.0221	2,027	14.23	94,796	0.0140	1,331	16.96
71	89,800	0.0243	2,179	13.54	93,465	0.0155	1,449	16.20
72	87,621	0.0267	2,343	12.87	92,016	0.0171	1,574	15.44
73	85,278	0.0295	2,519	12.21	90,442	0.0189	1,708	14.70
74	82,759	0.0327	2,704	11.56	88,734	0.0209	1,852	13.98
75	80,055	0.0362	2,894	10.94	86,882	0.0231	2,006	13.27
76	77,161	0.0400	3,089	10.33	84,876	0.0256	2,171	12.57
77	74,072	0.0443	3,285	9.74	82,705	0.0284	2,349	11.88
78	70,787	0.0492	3,480	9.17	80,356	0.0316	2,540	11.22
79	67,307	0.0545	3,670	8.61	77,816	0.0353	2,743	10.57
80	63,637	0.0605	3,851	8.08	75,073	0.0394	2,958	9.93
81	59,786	0.0672	4,020	7.57	72,115	0.0441	3,183	9.32
82	55,766	0.0747	4,168	7.08	68,932	0.0496	3,417	8.73
83	51,598	0.0831	4,289	6.61	65,515	0.0558	3,654	8.16
84	47,309	0.0924	4,373	6.17	61,861	0.0629	3,889	7.61
85	42,936	0.1028	4,413	5.74	57,972	0.0709	4,112	7.09
86	38,523	0.1142	4,400	5.34	53,860	0.0800	4,310	6.59
87	34,123	0.1268	4,327	4.97	49,550	0.0902	4,469	6.12
88	29,796	0.1405	4,188	4.62	45,081	0.1015	4,575	5.68
89	25,608	0.1554	3,980	4.29	40,506	0.1139	4,614	5.26
90	21,628	0.1713	3,706	3.99	35,892	0.1275	4,575	4.87
91	17,922	0.1882	3,373	3.71	31,317	0.1422	4,453	4.51
92	14,549	0.2058	2,995	3.45	26,864	0.1580	4,246	4.18
93	11,554	0.2241	2,589	3.22	22,618	0.1750	3,959	3.87
94	8,965	0.2429	2,178	3.00	18,659	0.1931	3,602	3.58
95	6,787	0.2621	1,779	2.80	15,057	0.2121	3,194	3.32
96	5,008	0.2816	1,410	2.62	11,863	0.2320	2,752	3.08
97	3,598	0.3018	1,086	2.45	9,111	0.2528	2,303	2.86
98	2,512	0.3227	811	2.30	6,808	0.2743	1,867	2.66
99	1,701	0.3441	585	2.15	4,941	0.2965	1,465	2.47
100	1,116	0.3661	409	2.02	3,476	0.3192	1,110	2.31
101	707	0.3884	275	1.90	2,366	0.3424	810	2.15
102	432	0.4111	178	1.78	1,556	0.3658	569	2.02
103	254	0.4340	110	1.68	987	0.3893	384	1.89
104	144	0.4568	66	1.59	603	0.4128	249	1.78
105	78	0.4796	37	1.50	354	0.4361	154	1.67
106	41	0.5022	21	1.42	200	0.4590	92	1.58
107	20	0.5243	10	1.35	108	0.4813	52	1.50
108	10	0.5458	5	1.28	56	0.5029	28	1.42
109	5	0.5667	3	1.22	28	0.5235	15	1.36
110	2	0.5866	1	1.17	13	0.5431	7	1.30
111	1	0.6054	1	1.12	6	0.5615	3	1.25
112	0	0.6229	0	1.08	3	0.5784	2	1.20
113	0	0.6391	0	1.05	1	0.5938	1	1.16
114	0	0.6536	0	1.02	0	0.6075	0	1.13
115	0	0.6664	0	0.99	0	0.6195	0	1.10
116	0	0.6786	0	0.96	0	0.6300	0	1.07



**Table 64 Life Table of Canada less Québec Beneficiaries with CPP (2007)**

Age	Males				Females			
	$l_x$	$q_x$	$d_x$	$e_x$	$l_x$	$q_x$	$d_x$	$e_x$
65	100,000	0.0136	1,363	17.87	100,000	0.0083	827	21.14
66	98,637	0.0151	1,485	17.11	99,173	0.0091	898	20.31
67	97,152	0.0166	1,612	16.37	98,275	0.0100	980	19.49
68	95,540	0.0182	1,743	15.64	97,295	0.0110	1,072	18.69
69	93,797	0.0200	1,880	14.92	96,223	0.0122	1,173	17.89
70	91,917	0.0220	2,023	14.21	95,050	0.0135	1,282	17.10
71	89,894	0.0242	2,177	13.52	93,768	0.0149	1,400	16.33
72	87,717	0.0267	2,343	12.84	92,368	0.0165	1,525	15.57
73	85,374	0.0295	2,518	12.18	90,843	0.0183	1,659	14.82
74	82,856	0.0326	2,703	11.54	89,184	0.0202	1,802	14.09
75	80,153	0.0361	2,894	10.91	87,382	0.0224	1,955	13.37
76	77,259	0.0400	3,089	10.30	85,427	0.0248	2,118	12.66
77	74,170	0.0443	3,287	9.71	83,309	0.0275	2,295	11.97
78	70,883	0.0492	3,485	9.13	81,014	0.0307	2,484	11.30
79	67,398	0.0546	3,679	8.58	78,530	0.0342	2,688	10.64
80	63,719	0.0606	3,864	8.05	75,842	0.0383	2,905	10.00
81	59,855	0.0674	4,036	7.54	72,937	0.0430	3,137	9.38
82	55,819	0.0750	4,187	7.04	69,800	0.0484	3,380	8.78
83	51,632	0.0835	4,310	6.57	66,420	0.0547	3,631	8.20
84	47,322	0.0929	4,395	6.13	62,789	0.0618	3,882	7.64
85	42,927	0.1033	4,435	5.70	58,907	0.0700	4,122	7.11
86	38,492	0.1149	4,421	5.30	54,785	0.0792	4,338	6.61
87	34,071	0.1276	4,348	4.93	50,447	0.0895	4,513	6.14
88	29,723	0.1416	4,208	4.57	45,934	0.1009	4,633	5.69
89	25,515	0.1567	3,999	4.25	41,301	0.1134	4,684	5.27
90	21,516	0.1730	3,722	3.94	36,617	0.1271	4,653	4.88
91	17,794	0.1902	3,385	3.66	31,964	0.1419	4,534	4.52
92	14,409	0.2083	3,002	3.41	27,430	0.1577	4,327	4.18
93	11,407	0.2271	2,590	3.17	23,103	0.1747	4,036	3.87
94	8,817	0.2463	2,172	2.96	19,067	0.1927	3,674	3.59
95	6,645	0.2661	1,768	2.76	15,393	0.2116	3,258	3.33
96	4,877	0.2861	1,395	2.58	12,135	0.2316	2,810	3.09
97	3,482	0.3068	1,068	2.41	9,325	0.2523	2,353	2.86
98	2,414	0.3282	792	2.26	6,972	0.2739	1,909	2.66
99	1,622	0.3501	568	2.11	5,063	0.2961	1,499	2.48
100	1,054	0.3724	392	1.98	3,564	0.3188	1,136	2.31
101	662	0.3950	261	1.86	2,428	0.3420	830	2.16
102	401	0.4179	168	1.75	1,598	0.3654	584	2.02
103	233	0.4408	103	1.65	1,014	0.3890	394	1.89
104	130	0.4637	60	1.56	620	0.4125	256	1.78
105	70	0.4863	34	1.48	364	0.4358	159	1.67
106	36	0.5087	18	1.40	205	0.4587	94	1.58
107	18	0.5305	10	1.33	111	0.4811	53	1.50
108	8	0.5517	4	1.27	58	0.5027	29	1.42
109	4	0.5721	2	1.21	29	0.5234	15	1.36
110	2	0.5914	1	1.16	14	0.5430	8	1.30
111	1	0.6097	1	1.11	6	0.5613	3	1.25
112	0	0.6266	0	1.08	3	0.5783	2	1.20
113	0	0.6421	0	1.04	1	0.5937	1	1.16
114	0	0.6561	0	1.01	0	0.6075	0	1.13
115	0	0.6683	0	0.99	0	0.6194	0	1.10
120	0	0.6786	0	0.96	0	0.6295	0	1.08

**Table 65 Life Table of Canada less Québec Beneficiaries without CPP (2007)**

Age	Males				Females			
	$l_x$	$q_x$	$d_x$	${}^{\circ}e_x$	$l_x$	$q_x$	$d_x$	${}^{\circ}e_x$
65	100,000	0.0237	2,375	17.55	100,000	0.0136	1,365	20.13
66	97,625	0.0230	2,241	16.96	98,635	0.0141	1,391	19.40
67	95,384	0.0227	2,165	16.35	97,244	0.0147	1,430	18.67
68	93,219	0.0229	2,137	15.72	95,814	0.0155	1,482	17.94
69	91,082	0.0236	2,145	15.07	94,332	0.0164	1,546	17.21
70	88,937	0.0246	2,184	14.43	92,786	0.0175	1,623	16.49
71	86,753	0.0260	2,254	13.78	91,163	0.0187	1,709	15.78
72	84,499	0.0280	2,362	13.13	89,454	0.0202	1,806	15.07
73	82,137	0.0305	2,508	12.49	87,648	0.0218	1,914	14.37
74	79,629	0.0336	2,678	11.87	85,734	0.0237	2,034	13.68
75	76,951	0.0371	2,858	11.27	83,700	0.0259	2,167	13.00
76	74,093	0.0409	3,030	10.68	81,533	0.0284	2,314	12.33
77	71,063	0.0448	3,186	10.12	79,219	0.0312	2,473	11.68
78	67,877	0.0489	3,322	9.57	76,746	0.0344	2,642	11.04
79	64,555	0.0533	3,443	9.04	74,104	0.0381	2,820	10.41
80	61,112	0.0582	3,554	8.52	71,284	0.0422	3,007	9.81
81	57,558	0.0636	3,662	8.01	68,277	0.0468	3,198	9.22
82	53,896	0.0699	3,769	7.52	65,079	0.0521	3,391	8.64
83	50,127	0.0772	3,872	7.05	61,688	0.0581	3,582	8.09
84	46,255	0.0856	3,960	6.60	58,106	0.0649	3,771	7.56
85	42,295	0.0951	4,020	6.17	54,335	0.0727	3,949	7.05
86	38,275	0.1055	4,036	5.76	50,386	0.0815	4,107	6.56
87	34,239	0.1167	3,994	5.38	46,279	0.0914	4,232	6.10
88	30,245	0.1285	3,886	5.03	42,047	0.1025	4,309	5.66
89	26,359	0.1410	3,716	4.70	37,738	0.1146	4,325	5.25
90	22,643	0.1542	3,491	4.39	33,413	0.1279	4,273	4.87
91	19,152	0.1682	3,221	4.10	29,140	0.1423	4,148	4.51
92	15,931	0.1832	2,918	3.82	24,992	0.1580	3,949	4.17
93	13,013	0.1991	2,591	3.57	21,043	0.1749	3,680	3.86
94	10,422	0.2159	2,251	3.33	17,363	0.1930	3,351	3.58
95	8,171	0.2336	1,909	3.11	14,012	0.2122	2,974	3.31
96	6,262	0.2518	1,577	2.90	11,038	0.2324	2,566	3.07
97	4,685	0.2709	1,269	2.71	8,472	0.2535	2,148	2.85
98	3,416	0.2909	994	2.54	6,324	0.2753	1,741	2.65
99	2,422	0.3117	755	2.37	4,583	0.2978	1,365	2.46
100	1,667	0.3333	556	2.22	3,218	0.3208	1,032	2.29
101	1,111	0.3555	395	2.08	2,186	0.3441	752	2.14
102	716	0.3784	271	1.94	1,434	0.3677	527	2.00
103	445	0.4018	179	1.82	907	0.3914	355	1.88
104	266	0.4255	113	1.71	552	0.4150	229	1.77
105	153	0.4495	69	1.61	323	0.4384	142	1.66
106	84	0.4735	40	1.52	181	0.4613	83	1.57
107	44	0.4974	22	1.43	98	0.4836	47	1.49
108	22	0.5210	11	1.36	51	0.5051	26	1.42
109	11	0.5441	6	1.29	25	0.5256	13	1.35
110	5	0.5665	3	1.22	12	0.5450	7	1.29
111	2	0.5879	1	1.17	5	0.5632	3	1.24
112	1	0.6081	1	1.12	2	0.5799	1	1.20
113	0	0.6268	0	1.07	1	0.5951	1	1.16
114	0	0.6440	0	1.04	0	0.6085	0	1.13
115	0	0.6592	0	1.00	0	0.6203	0	1.10
120	0	0.7000	0	0.80	0	0.6500	0	0.85

## B. Derivation of Annual Crude Mortality Rates

The main method used to determine annual crude mortality rates was the product-limit estimator method.

### *Product-Limit Estimator (PLE) Method*

With the advent of calculators, and later of computers, methods to estimate crude mortality rates have improved, and the PLE<sup>1</sup> method is such an example. This method produces survival rates from which mortality rates are easily obtained, whereas other methods produce mortality rates by taking ratios of deaths to exposures. The PLE method does not use exposures, but rather considers the product of survival probabilities across ages.

The one-year interval between two consecutive ages is divided into 24 subintervals of half a month each. For each subinterval  $i$ , where  $i = 0, 1, 2, \dots, 23$ , an estimate,  $N_x(i)$ , is made of the number of people age  $(x) + i/24$  observed at the beginning of the subinterval, and an estimate,  $D_x(i)$ , is made of the number of deaths between ages  $(x) + i/24$  and  $(x) + (i+1)/24$  observed during the subinterval (i.e. in subinterval  $i$ ). A survival rate,  $p_x(i)$ , for the subinterval is then estimated by the ratio of the number of people who survive the subinterval to the number of people observed at the beginning of the subinterval, such that  $p_x(i) = (N_x(i) - D_x(i)) / N_x(i)$ .

The annual crude survival rate,  $p_x$ , is then estimated as the product of the 24  $p_x(i)$  survival rates within the one-year age interval. Some adjustments are made for incomplete ages. For example, the adjustment at age 65 of  $p_{65}^{adj} \cong p_{65}^{24/23}$  is made to account for the fact that the age of OAS entitlement is defined to be at the beginning of the month immediately following the 65<sup>th</sup> birthday. For each age  $(x)$ , the annual crude mortality rate,  $q_x$ , is then determined simply as the complement of the survival rate,  $1 - p_x$ .

The PLE method produces estimators that are more complex to generate and have higher variance, but that are said to be true maximum likelihood estimators (under certain conditions) of crude mortality rates.<sup>2</sup>

The annual crude mortality rates in this study are derived from the PLE method because of its sound statistical basis and the fact that it does not require any particular mortality assumption.

<sup>1</sup> Also referred to as the Kaplan-Meier Estimator.

<sup>2</sup> Broffitt, J. D. 1984. *Maximum Likelihood Alternatives to Actuarial Estimators of Mortality Rates*. Transactions of Society of Actuaries, 36: 77-142.

### C. Derivation of Base Year Crude Mortality Rates and Mortality Improvement Rates

The 2007 base year crude mortality rates are based on the observation period spanning from 2005 to 2009 inclusive, and the annual mortality improvement rates were determined over the period 2001 to 2009 inclusive. The use of five years of data to determine the crude mortality rates reduces statistical fluctuations that may result if only one year of data were used. Similarly, the use of a longer period (nine years compared to five used in the previous study) to determine the improvement rates reduces statistical variation in the results.

Four methods were used to derive the 2007 base rates from the annual crude mortality rates over the five years. Among these four methods, three of them (Methods 2, 3, and 4) adjust the resulting rates by explicitly taking into account mortality improvements that are observed over the study period. Specifically, these three methods all use least squares linear regression models in order to explicitly take into account mortality improvements. The use of least squares regression produces two sets of results: base mortality rates adjusted for mortality improvements and mortality improvement factors. The mortality improvement rates were determined using Methods 2, 3, and 4 (over the period 2001 to 2009).

The following describes all four methods.

1. Method 1 is the Product-Limit Estimator method applied to the aggregated number of beneficiaries,  $N_x$ , and number of deaths,  $D_x$ , over the five-year period of the study. As compared to Method 2 (below), the main drawback of Method 1 is that it does not account explicitly for multiplicative annual mortality improvement factors; however, since it is based on only five years of data, it produces values close to those obtained by Method 2.
2. Method 2 consists of five-year least squares regressions on the natural logarithm ( $\ln$ ) of the annual crude mortality rates performed separately for each possible combination of age, sex and other subcategories. The least squares regressions allow for the derivation of the 2007 base year crude rates and the mortality improvement rates at the same time.

Five data points (one for each year from 2005 to 2009) are used to obtain a 2007 base year crude mortality rate for a particular age ( $x$ ) and a multiplicative mortality improvement factor (MMIF). The resulting mortality improvement factor is simply  $1/\text{MMIF}$ . For example, a MMIF of 0.97 results in a mortality improvement factor of 0.03 or 3%. The simplified mathematical model is:

$$q_x^{\text{year}} = q_x^{2007} * \text{MMIF}_x^{\text{year}-2007} \rightarrow \ln(q_x^{\text{year}}) = \ln(q_x^{2007}) + (\text{year}-2007) * \ln(\text{MMIF}_x),$$

where  $q_x^{\text{year}}$  is the crude mortality rate for a given year and age ( $x$ ) obtained via the Product-Limit Estimator method, as described earlier.

3. Method 3 consists of five-year and five-age least squares regressions to estimate a set of five central rates of mortality ( $m_x$ ) for any combination of age, sex, and other subcategories. The central rate of mortality for the age range ( $x$ ) to ( $x+1$ ) is the probability that a life between the ages ( $x$ ) and ( $x+1$ ) dies before reaching age ( $x+1$ ). Methods 3 and 4 both use twenty-five data points to produce different mortality rates



for five successive ages while producing only one average mortality improvement factor for the corresponding quinquennial age group. Unlike the other three methods, Method 3 does not require the annual crude mortality rates, since it produces the central rates of mortality from basic exposures and deaths. For ages between ( $x_0$ ) and ( $x_{0+4}$ ) (where  $x_0$  is age 65, 70, 75, etc.) the mathematical model uses a multiplicative survival improvement factor (MSIF) for each age group. (The crude survival rates,  $p_x$ , are transformed into mortality rates,  $q_x$ , in order to compute the resulting mortality improvement factors.) The model is of the form:

$$p_x^{\text{year}} = p_x^{2007} * (\text{MSIF}_{x_0})^{\text{year}-2007} \rightarrow -\ln(p_x^{\text{year}}) = -\ln(p_x^{2007}) - (\text{year}-2007)*\ln(\text{MSIF}_{x_0}),$$

where  $p_x^{\text{year}}$  is the crude survival rate for a given year and age ( $x$ ) obtained by the Product-Limit Estimator method, as described earlier.

Under a constant force of mortality assumption, this simplifies to:

$$m_x^{\text{year}} = m_x^{2007} - (\text{year}-2007)*\ln(\text{MSIF}_{x_0})$$

$$D_x^{\text{year}}/E_x^{\text{year}} = m_x^{2007} - (\text{year}-2007)*\ln(\text{MSIF}_{x_0}),$$

where  $D_x$  and  $E_x$  are the number of deaths and exposures, respectively, for age ( $x$ ). This method produces five central rates of mortality for any combination of subcategories and one MSIF for each quinquennial age group.

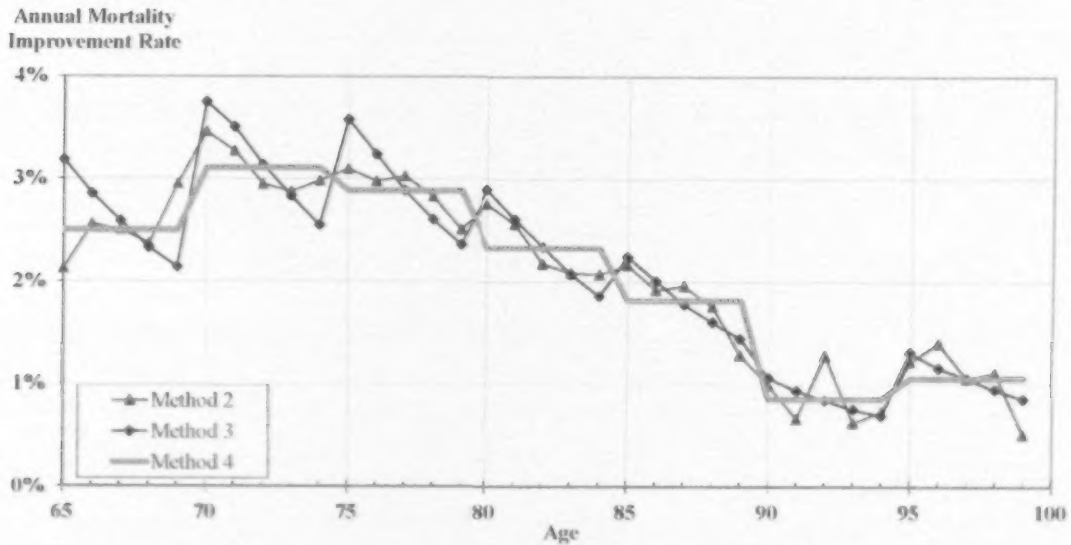
4. Method 4 is a combination of Methods 2 and 3. It is similar to Method 2 except that it is applied to five different ages at the same time. However, unlike Method 3, this method uses annual crude mortality rates instead of central rates of mortality and produces one MMIF for each quinquennial group.

Although the four methods produce close results, Method 4 was chosen as the best one to estimate the 2007 base year crude mortality rates. Method 1 was not selected since it does not produce mortality improvement factors. Method 2 was not selected because in comparison with Methods 3 and 4, the improvement factors are less statistically significant when computed by age group, since fewer data points are used. Although both Methods 3 and 4 are very good, Method 4 was ultimately selected because it uses annual crude mortality rates based on product limit estimators.

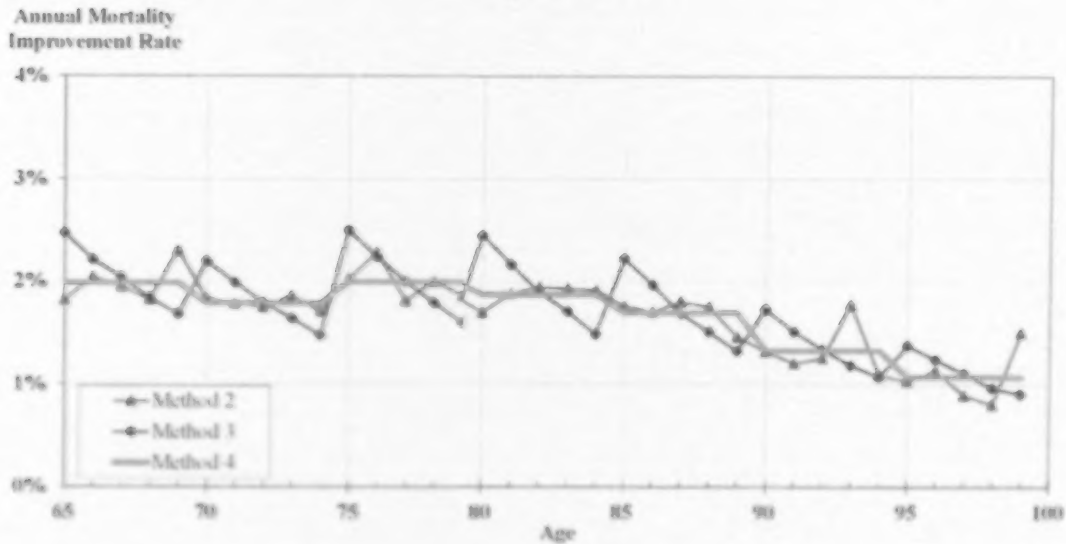
A comparison of the annual mortality improvement rates produced by each regression-based method (Methods 2, 3, and 4) is shown in Chart 19. All three methods show that, except at the very advanced ages, male improvement rates have been both greater than female rates and exhibit a clearer declining pattern with age.

**Chart 19 OAS Beneficiary Annual Mortality Improvement Rates by Method (2001-2009)**

### Males



### Females



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